AN EVALUATION OF THE CARPOOL PROGRAM AT THE UNIVERSITY OF FLORIDA

By

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A FINAL PROJECT PRESENTED TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING, COLLEGE OF DESIGN, CONSTRUCTION AND PLANNING AT THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN URBAN AND REGIONAL PLANNING

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Abstract of a final project presented to the Department of Urban and Regional Planning, College of Design, Construction and Planning at the University of Florida in partial fulfillment of the requirements for the Degree of Master of Arts in Urban and Regional Planning

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Major Department: Urban and Regional Planning

The University of Florida reactivated its carpool program in May 1997. The purpose of this project is to evaluate how successful the project has been using various performance indicators within three main perspectives – the University, the surrounding communities, and the participants of the program. This project also determines whether the participants are abusing the carpool program, how the administration of the program and university policy may be contributing to the performance of the program, and provides recommendations about how the program could be modified to improve its performance. Some analysis, discussion and recommendations are also provided regarding university policies, especially parking, because of the close relationship they have with the performance of the carpool program. The research for this project primarily included monitoring carpool spaces for occupancy, a preparing a survey of demographic and travel behavior sent to all program members' campus mailing addresses, collecting additional demographic and transportation data from UF and the local community, analyzing the spatial distribution of members' home addresses for distance and compatibility, and researching carpooling and transportation data and policies from other universities nationwide.

The results of the evaluation were that the carpool program was marginally to moderately successful in eliminating vehicles and reducing parking demand from the perspective of the University, and marginally to moderately successful in eliminating vehicle-trips and miles of travel from the perspective of the surrounding community although somewhat less successful

than from the perspective of the University, when only considering the before and after travel behavior of the participants of the carpool program. When considering the entire University community, the program has provided an almost negligible amount of savings. The program has been most beneficial for the participants of the program who for the most part find it very convenient and enjoy the benefits and the incentives that the program has to offer. Unfortunately, it is probably at the expense of the efficiency of the program from the perspective of the University and the surrounding community. The University's administration of the program is probably a major contributing factor to the limited effectiveness of the program and to the abuse of the program by the participants, which was approximated at a maximum of one-third of the participants per day but probably closer to 25% per day. Another major contributing factor to the limited effectiveness of the carpool program is that only around one-half of the participants previously drove alone to campus before joining the carpool program.

Some of the recommendations to improve the effectiveness of the carpool program are to clarify the program requirements, initially screen all participants for meeting the requirements of the program, initiate an active matching program to assist employees find compatible partners, change the minimum number of persons per carpool from three to two but charge a fee for all participants to join the program, advertise and inform the campus population better about the carpool program, and hire a full-time alternative transportation coordinator and additional staff as necessary that will be able to manage and administer the additional work load (to be funded easily by additional carpool and parking fees). Additional longer-term recommendations, which also include changes to UF transportation and parking policy, are to significantly raise the price of regular parking decals especially in core campus and high demand parking areas, determine potential areas where reserved carpool parking locations can be consolidated and generalized to include potential areas for daily carpooling and access control, consider limiting the number of regular parking decals sold to employees and students that live very close to the University, closely work with the City of Gainesville and Alachua County to ensure they assist and complement the efforts at UF, and seriously consider convening another task force involving various groups of the campus and local community to develop a comprehensive TDM and alternative transportation program that would sufficiently benefit all groups within the UF campus and local communities.

Chapter 1 History and Description of Research Problem

Background

Like many universities, the University of Florida (UF) is faced with a high demand for parking and much associated traffic congestion. In the year 2000, UF has over 45,000 students including over 39,000 full-time students, almost 12,000 full-time employees, over 3,500 temporary employees designated as Other Personnel Services, many of whom work full-time, and almost 5,500 employees that work for Shands Hospital at UF. While the number of UF and Shands employees has remained fairly constant in recent years, the number of students has grown significantly over the past four years, increasing by around 6,000 in both overall and full-time categories. Accounting for Hospital Residents, Post Doctoral Associates, and daily visitors to UF and Shands, UF easily attracts 60,000 people to campus during a normal weekday. Out of this number, approximately 30,000 of the campus' population purchase a decal to park on campus. To accommodate these vehicles, UF had approximately 22,800 total parking spaces in October 1999. However out of these spaces, about 3,500 spaces are reserved for state, service, handicap, and other reserved parking, as well as visitor, meter, and short-term parking. Therefore, the number of parking spaces for the general population is approximately 19,300 parking spaces (UF Transportation and Parking Services, 2000).

With over 10,000 more decals sold than there are spaces available, an excess demand to supply ratio of approximately 1.5 currently exists at UF. This is somewhat mitigated in that not everyone with a decal parks on campus at the same time, and parking is available in neighborhoods immediately surrounding the Main Campus and Shands Hospital although in very limited quantity. By right, this parking is restricted to neighborhood residents and visitors (to residences, local shops, and offices), while additional parking is located along SW 16th Avenue and within a pay lot along NW 1st Avenue. However, more UF daily commuters than allowed by local codes typically park in these neighborhoods. Property owners, landlords, and residents often allow multiple cars to park on their property, while other commuters park directly on the street without a city decal or on other properties without the owner's approval.

Even with these mitigating factors, there is still a large excess demand for parking at UF. This is especially true of parking spaces within the core areas and other popular destinations on campus where parking space is even more limited. Over time, much of the available parking in high demand areas on campus have been converted to new buildings or building expansions, removed to make the campus more pedestrian and bicycle-friendly, or converted to reserved spaces and thus is no longer available to the general population. The rate of construction of new parking has been greater than the removal of this existing parking – an increase by almost 4,000 from 1993 when there were 19,000 total spaces. However, most of the new parking has been located outside of core and high-demand areas and does not make up for the lost premium parking. The result has been an increasing demand for close-in parking even though the overall demand has decreased over time. See Table A.1 in Appendix 4 for history of parking demand at UF.

With the host city of Gainesville, Florida having less than 100,000 residents and a metropolitan population of about 150,000, UF by far is largest generator and attractor of trips to the Gainesville metropolitan area. It is also probably the greatest source of traffic congestion on the many roads that approach Gainesville, especially around the University, as manifested in poor roadway levels of service. The Gainesville Comprehensive Plan and Urbanized Area Metropolitan Transportation Planning Organization (MTPO) have defined the following major roadways as having unacceptable levels of service (LOS E or F):

Table 1.1 – Roadways in Gainesville with unacceptable levels of service

Road Segment	From	To	Level of Service
US 441/W 13th Street	NW 29th Road	SW Archer Road	LOS F
SR 121/NW 34th Street	NW 16th Avenue	W University Ave	LOS F
SR 26/W University Ave	North-South Drive	W 13th Street	LOS E
SR 26A/SW 2nd Avenue	Newberry Road	SW 34th Street	LOS E
NW 8th Avenue	NW 22nd Street	NW 6th Street	LOS E
North-South Drive	W University Avenue	Museum Road	LOS F
Hull-Mowry Road	SW 34th Street	Center Drive	LOS F
Radio-Museum Road	SW 34th Street	SW 13th Street	LOS E

Among these roadways, the last three are located on University property and LOS is determined using the Florida Department of Transportation's (FDOT) ART-PLAN model analysis. The ART-PLAN model calculates LOS by accounting for roadway specific conditions, such as

intersection design (i.e. turning lanes and signalization), and lane and should width, to improve LOS defined in generalized tables. While not specifically identified with a LOS E or F, additional roadways within Gainesville have increasing loads of congestion. Table 1.2 identifies other road segments that have had a significant increase in congestion between 1991 and 1999. Many of the road segments within Table 1.1 also had a large increase in congestion, such as W 13th Street (by over 5,000 ADT) and W University Avenue (by over 7,000 ADT).

Table 1.2 – Increase in Average Daily Trips for Gainesville roadways not at LOS E or F

Road Segment	From	To	Increased Average Daily Trips, 1991-1999
SW Archer Road	I-75	SW 16th Avenue	15,870
SW 34th Street	SW Archer Road	W University Avenue	9,590
SW 34th Street	SW Williston Road	SW Archer Road	7,573
SW Archer Road	SW 16th Avenue	SW 13th Street	4,335
Newberry Road	NW 8th Avenue	W 34th Street	4,065
SW 6th Street	SW 4th Avenue	SW 16th Avenue	2,864
SW 16th Avenue	SW Archer Road	SW 13th Street	2,160
SW 13th Street	SW Williston Road	SW Archer Road	2,130

With a high, and still seemingly increasing demand for parking and traffic congestion, UF and community transportation planners have looked to transportation alternatives to the single-occupant automobile to improve the efficiency of transportation and parking infrastructure in and around campus. This has been manifested in the UF 1994 – 2004 Campus Master Plan (CMP), Campus Development Agreement (CDA) with the host community of Gainesville, and various projects and programs that UF has undertaken in the last six years. The CMP and CDA outlined the University's commitment to work with and remain consistent with goals, objectives, and policies of Gainesville, Alachua County, and the MTPO on proposed transportation improvements. Goal 1.0 of the CMP specifically also shows the University's commitment to "a convenient, safe, cost effective and accessible transportation system… which supports and encourages the use of alternative transportation." Specific areas in which the CMP proposed to provide viable alternatives to single-occupant automobiles included providing zones where automobile traffic would be restricted, encouraging greater pedestrian and bicycle commuting by enhancing safety, the on-campus environment, and improving infrastructure for bicycles on major roadways and within expanded auto-free areas, encouraging subsidized regional bus service to improve service between off-campus student housing and the University, and

enhancing on-campus bus shuttle service. The University would also price parking to cover the cost of facility improvements and transit support services, and limit the increase in parking on campus to 2,700 net additional spaces (accounting for an addition of 4,100 spaces and reduction in 1,400 spaces due to new construction) while providing new parking in peripheral areas of campus, primarily for commuters and Shands Hospital.

In accordance with the CMP, UF has performed the following over the last five years:

- Formulation of the Presidential Task Force on Transportation and Parking in 1995 and subsequent recommendations for UF to deal with all forms of traffic circulation, vehicular parking, and safety issues related to transportation on campus.
- Provided free transit service for students upon showing their UF student identification cards to use Gainesville's Regional Transit System (RTS) and university circulator buses, subsidized by various funding sources including student transportation fees. Employees were originally discounted but now can also ride free upon showing their UF employee identification card.
- Entered into an agreement with RTS and the Oaks Mall for express shuttle and park and ride service between the Oaks Mall and UF, although the service was recently discontinued due to lack of consistent ridership.
- Expanded the auto-restriction zone in the core area of main campus both spatially in the northeast quadrant at Stadium Road, Newell Drive, and Union Road, and temporally from 8:30 AM to 4:00 PM.
- Increased the price for all parking decals roughly 5% per year.
- Reduced or eliminated on-street parking in high pedestrian, narrow roadway areas such as Union Road, Inner Road, Newell Drive, and Fletcher Drive.
- Increased the number of bicycle and pedestrian pathways, lanes, and bicycle racks at various locations.

Some of the specific recommendations of the Presidential Task Force on Transportation and Parking in 1996 included enhanced transportation zones (ETZs) of improved transit, bicycle, and pedestrian service where students living in these zones would not be permitted to purchase decals

once the enhancements were in place, and a revised system of parking that reduced the number of available student parking spaces by 2,700, increased available employee parking spaces by 1,800, provided a tiered system of permitting based on priority where higher priority spaces were priced higher, removed on-street parking to improve pedestrian and bicycle convenience, and expanding the time at which parking on campus would be restricted to students until after 6:30 PM. Additional recommendations included expanding auto-free zones with traffic barrier gates, providing a system of on-campus pathways and dedicated lanes for pedestrians and bicyclists, and setting up a commuter assistance program to assist with carpool matching and emergency rides home. The overall implementation would be self-sufficient with revenues covering all costs of implementation, and included a general student transportation fee, a transportation tax applied to all tickets sold for special events, and increased annual parking fees as indicated below:

	Employee	Student
Priority	$500	N/A
Premium	$250	$150
Standard	$125	$75
Off-Campus/Remote	N/A	$75

Many of the Presidential Task Force's recommendations were physically implemented, although the proposed reallocation of employee and student parking, the changes in prices, the implementation of the ETZs, and expanding the time that parking would be regulated have not yet occurred. While not part of the original CMP, the updated 1996 Transportation Element called for implementation of Transportation Demand Management (TDM) strategies by August 1997 that encourages alternative transportation and reduces single-occupant vehicle (SOV) commuting, including:

- Reactivation of the carpool program with incentives such as preferential parking locations and reduced parking fees.
- Restrict on-campus parking for freshmen and sophomores during parking enforcement hours.
- Evaluating parking pricing strategies designed to make other modes of travel more economical and attractive.

Reactivation of the Carpool Program

In May 1997, UF implemented its carpool program. Three years later, over 230 carpools are in existence at UF accounting for over 600 University and Shands employees. Major components of the carpool program include the following:

- All participants must be day shift employees of the University or affiliated organization, including Shands Hospital and OPS professional employees.
- Each carpool must have a minimum of three people. Two are acceptable if both reside outside of Alachua County (UF's host county).
- Carpool permits are free for three person carpools and $84 total per year for two person carpools.
- Participants are not allowed to hold another valid UF parking decal, and must turn in any existing parking decal they had previously purchased.
- All members must begin work at about the same time of day and live within a reasonable commute path of each other.
- Each carpool group receives a reserved space of its choice in standard employees parking locations between 7:30 AM and 5:00 PM.
- Each carpool group must renew their participation annually at the Transportation and Parking Services Decal Office. The annual duration of membership runs from May 1st to April 30th. If a group fails to renew, then their reserved space is removed (opened for general use).
- Each member of a carpool group receives four one-day passes per semester to park individually when unable to carpool. Each member must individually collect his or her own passes at the Decal Office at the beginning of each semester.
- Members are provided a guaranteed ride home during business hours if an unexpected personal emergency occurs. Additionally, members are reimbursed for cab fare home if required by a supervisor to work late when providing advanced notice and a valid receipt of fare to Transportation and Parking Services.

- A bulletin board is available for people seeking other potential carpool members to place and advertisement on UF's Transportation and Parking Services internet website.
- Transportation and Parking Services must be notified immediately if a member leaves the carpool for any reason. If a group loses eligibility to participate after a member leaves the program, they have one week to find another member before their reserved space is opened for general use.
- Carpool groups failing to inform Transportation and Parking Services when a member leaves, or otherwise failing to meet eligibility requirements are subject to revocation of their carpool permit, a $100 fine, and will not be eligible for the program for at least the remainder of the applicable year.

During the three years the carpool program has been in existence at the University of Florida, there has been no attempt to determine whether or not the program has been successful. All other attempts at having an organized carpool program, including student carpools, have been abandoned at the University of Florida. A city / regional transportation management association has also been abandoned in recent years prior to this latest incarnation of a university carpool program. In light of the failure of previous programs, it is important to determine whether or not this program is effective and useful and to identify areas where the program can be improved; otherwise, this program may also be abandoned without giving it a proper chance to succeed. Additionally, not only could lessons learned from this project apply to the University of Florida, but potentially to universities similarly situated that may be having similar issues or looking to start or improve their own carpool program.

The Research Problem

The main question this project attempts to answer is whether the carpool program is effective as currently implemented. The three main areas in which this project attempts to determine effectiveness are from the perspectives of:

- The University of Florida (UF)
- The communities surrounding UF, including but not limited to Gainesville and Alachua County, and

- The participants of the carpool program.

From the University's perspective, the major issue is whether traffic and the demand for parking have been reduced at the University since the implementation of the carpool program. On the surface, it may appear that over 600 people carpool to the University every day. However, various complaints have been made by segments of the campus population that many of these people were already carpooling, many new carpoolers were drawn from other modes of alternative transportation, and many participants do not use the carpool as their primary mode of transportation, which enables the other person or persons within their particular group to commute either by themselves or below the minimum number of people assigned to their group (i.e. two people commuting in a designated three person carpool).

A similar issue is the frequency that carpools are actually occupying their reserved spaces. Reserving carpool spaces to individual groups has the effect of curtailing the unlimited use of those spaces, thus reducing the general availability of spaces. If these spaces are not regularly occupied, this gives the appearance that the spaces are being wasted and encourages the general population to complain that the reserved carpool spaces should be converted back to general use. In terms of equity and fairness, carpools with less than the minimum number of required occupants or not adequately occupying their reserved spaces also gives the impression that people are receiving free, reserved spaces while getting away with not having to carpool, or only carpooling some of the time. However, if the actual effect of the program is to shift a group of people who previously commuted alone every day to only a couple of days a week, then the program could still be considered moderately effective.

From the community's perspective, the major issue is whether peak-hour trips and total miles traveled by automobiles have been reduced on major roads surrounding and leading to UF. One would generally expect a carpool program with 600 participants to cause a certain decrease in automobile trips and miles traveled in the affected service areas. However, if most participants already carpooled before joining the program, while there may be a significant avoidance in peak-hour auto travel due to carpooling in general, it would not have been caused by the implementation of the program. Yet the program could still be considered effective if it

prevented a major defection of carpoolers to solo commuting. If the carpool program has attracted many new participants, a potential issue is whether these new participants are commuting far out of their way to meet each other prior to commuting to the university. Members not within a "reasonable commute path" will not generally provide a decrease in work-trips and potentially increase the amount of vehicle-miles traveled on major roads.

From the perspective of the participants of the carpool program, the major issue is whether the program is effective at attracting and retaining carpool participants. Over the last 30 to 40 years, the national trend has been a reduction in carpooling and an increase in single occupant automobile usage (Ferguson, 1994 and 1997, discussed in greater detail in Chapter 2). Generally people will not carpool unless it is more attractive than other transportation modes, especially the single-occupant vehicle. UF's carpool program has provided various benefits such as free and reserved parking, and guaranteed parking locations, so the issue becomes how effective are these and other strategies employed by the university to attract and retain carpool participants. However, certain benefits and strategies currently implemented within the program may be detrimental to the program from the perspective of the university or surrounding communities. For example, it is believed by the author that free parking for carpool program members may be enabling the recruitment of people that do not legitimately carpool because it costs nothing for an employee to include him or herself as part of a carpool group, especially if that person is not actually carpooling.

Because of all of the potential shortfalls that can reduce the effectiveness of the carpool program, certain changes in program strategies could improve the effectiveness of the program. Any changes made should attempt to make carpooling more attractive to the general campus population to encourage more participation, while retaining existing members and reducing the potential for abuse of the program. Changes should also not be too advantageous or disadvantageous to any particular group, although any policy change will have some implication on the campus population whether or not they participate in the program.

Research Questions

This research project will attempt to answer a number of questions that relate to the success and usefulness of the UF carpool program. From the perspective of the University, questions include:

- Has the demand for parking on campus decreased over the life of the program?
- More specifically, how many fewer vehicles are being brought to campus and how many fewer parking decals are sold as a result of the program?
- Has the oversell ratio of purchased decals to available parking spaces been reduced as a result of the program?
- How frequently are reserved carpool parking spaces being used, how many people are actually carpooling each day, and are these occupancy and participation rates considered efficient?
- Because carpool permits are free for three-person carpools and reduced price for two-person carpools, what is the reduction in revenue generated by the University and is this loss in revenue worth the savings that the carpool program is providing?

From the perspective of the surrounding community, specific questions to be addressed include:

- How many vehicle-trips and miles of travel are saved as a result of the program?
- Does this savings have an impact on local traffic conditions?
- Are carpool groups compatible in terms of home locations, and do compatible groups provide greater savings in terms of vehicle-trips and miles traveled?

From the perspective of the participants of the program:

- How important are the various incentives and benefits of the carpool program to the participants, and which benefits are more important than others?
- What specific likes and dislikes do participants have of the program, and how long have members typically been participating in the program?

These will provide some indication as to which incentives have been most effective in attracting and retaining people, and how effective certain changes might be in attracting future participants and retaining current members. The responses to many of these questions may also provide some indication about whether abuse is occurring within the program, and who specifically may be abusing the program. Also in terms of performance of the carpool program, additional questions include:

- To what extent is administration of the program by Transportation and Parking Services and UF policy contributing to the success (or possible lack thereof) of the carpool program?
- How does UF compare against other universities nationwide that have similar demographic characteristics to UF, and what policies and strategies implemented at these other universities have a realistic chance for improving the UF carpool program?
- Furthermore, which policies and strategies that currently exist at UF require adjustment to have the best chance at improving the carpool program, and what are the limitations of potential changes to the existing program?

Chapter 2 Literature Review

Growth and Problems with Increased Automobile Commuting

Over the past decades, the amount of traffic on American roadways has increased dramatically. Between 1975 and 1990, the number of annual vehicle miles of travel (VMT) increased by 822 billion miles, or roughly 62% (Downs, 1992). According to the 1999 annual compilation of National Transportation Statistics by the Bureau of Transportation Statistics (BTS), annual VMT increased by an additional 380 billion miles between 1990 and 1997, representing an approximate doubling of the total annual VMT since 1975, and an approximate quadrupling of total annual VMT since 1960 (USDOT, 1999). There are numerous reasons for this increase in travel, including growth in the national population and total households, greater employment opportunities for all people, and increases in licensed drivers – the percentage of growth between 1975 and 1990 being 34%, 22%, 32%, and 38%, respectively (Downs, 1992). As shown by these statistics, the rate of travel has increased far above these population increases. One major reason for a greater increase in travel than population is that more people are driving alone than in previous years. According to the U.S. Census Bureau, the percentage of all drive alone trips increased from 57.3% to 73.2% between 1970 and 1990 (Ferguson, 1997), to nearly 80% in 1995 (Hu and Young, 1999). According to the American Housing Survey in 1991, the drive alone rate was already over 80% (Ferguson, 1994).

The result of this enormous increase in travel has manifested itself in various ways, most notably increased congestion on American roadways, especially during peak commuting hours, increased consumption in energy and resources such as fuel, roadways, and natural resources, and increased environmental pollution. According to the Texas Transportation Institute (TTI), the cost of roadway congestion for America's largest 39 urban areas in 1988 was approximately $34 billion, or $290 per resident, where 65% was attributed to lost time (Downs, 1992). By 1990 this figure grew to $43 billion (NRC, 1994 citing Schrank, Turner, and Lomax, 1990), and by 1997 the financial cost of congestion exceeded **$72 billion** per year, more than double the cost identified less than 10 years earlier. The 1997 cost included 6.6 billion gallons of wasted fuel, more than twice the amount wasted 15 years earlier, while in more than half the cities studied the

amount of time drivers spent stuck in traffic had grown by at least **350 percent** within the previous 16 years (TTI, 1999).

According to BTS, the total number of paved roads and streets doubled from 1.23 to 2.41 million miles between 1960 and 1997. However, the rate of construction of new paved roads and streets has only been approximately one-half of the rate of increase of vehicle-miles traveled, while also slowing dramatically over the last half of this 37-year period - only 29% new miles constructed over the last half, and only 13% new miles constructed over the last quarter. Therefore over time, there has been far less infrastructure to handle the vast increases in vehicular travel in relative terms. Additional pertinent statistics from BTS include (USDOT, 1999):

- A 29% increase in the number of registered personal vehicles from 160 to 207 million between 1980 and 1997 (the 1997 figure representing approximately 0.75 vehicles per American resident, regardless of age).
- A 28% growth in demand for petroleum for automobile use and road construction, from 2.88 to 3.69 billion barrels of petroleum between 1980 and 1997.

One solution to handle increasing congestion is to construct more roadway infrastructure, including more paved roads and widening existing roads. However, it has become widely understood that increasing roadway infrastructure is not a good alternative for economic, environmental, accessibility, and other practical reasons. First off, constructing additional roadway infrastructure continues to get more and more expensive. A common figure in the early 1990s for the construction of one lane-mile of highway was $1.0 million (Tindale, 1991). Thus, widening a two-mile stretch of a two-lane road to a four-lane divided highway would cost approximately $4.0 million. Potential difficult site conditions such as terrain, soil conditions, and topography; additional design requirements for speed, capacity, drainage, and landscaping; as well as increasing costs for construction, maintenance and repair over time all serve to increase the total required funding for similar quantities infrastructure. Additionally, various sources have placed the cost of construction of parking facilities at between $1,000 and $6,000 per parking space for a flat surface parking lot, between $5,000 and $12,000 per parking space for an above ground parking garage, and $25,000 to $30,000 per space for a subterranean parking structure (Willson, 1992 and 1995, and Cornell, 1996). Considering that tax rates and

public funding have not kept up increasing demand for infrastructure, the ability to construct new infrastructure has been significantly reduced in recent years.

While increasing roadway infrastructure will temporarily relieve areas of congestion, quite often these areas quickly fill up to capacity due to the latent demand associated with an area. The term "triple convergence," where a combination of drivers formerly using other roadways, traveling during other time periods, and using other modes of transportation all converge on an area of increased or improved roadway infrastructure, has been used to explain how congested areas once their capacity is increased eventually fill up and become congested again (Downs, 1992). The same concept can also be used for parking infrastructure, where increasing the capacity of parking in high demand areas, usually by providing more parking spaces, will enable drivers formerly using other parking locations (presumably more remote), modes of travel (especially high occupancy vehicle modes – transit and ridesharing), and time of travel to quickly consume the additional capacity until parking is once again no longer available during high congestion periods. Another part of the triple convergence theory is that increasing roadway capacity attracts new development and thus also brings new motorists onto the road (NRC, 1994). Combining the concepts of high cost and limited effectiveness of increasing capacity, the Southern California Association of Governments in 1988 determined that if every conceivable addition of infrastructure was made, at a total cost of more than $100 billion, the level of congestion in the Los Angeles metropolitan area by the year 2010 would remain the same as it was in 1988 (Giuliano and Wachs, 1992 citing SCAG, 1988).

Recent national legislation has made it more difficult for governments to increase their roadway capacities, especially in those area failing to meet air quality standards as indicated within the Clean Air Act Amendments (CAAA) of 1990. Also under the CAAA, employers with 100 or more employers in locations designated by the U.S. Environmental Protection Agency as "serious or above" for ozone were required to implement trip reduction programs designed to reduce commute-related VMT by raising average vehicle occupancy for employee work trips at least 25% above the area average (Modarres, 1993 citing USEPA, 1991). Wide ranging examples of municipalities, counties, and regions that issued trip reduction ordinances (TROs) requiring various employers to implement trip reduction programs include Bellevue, WA,

Minnetonka, MN, New Brunswick, NJ, Maricopa County, AZ, Montgomery County, MD, and the South Coast Air Quality Management District (SCAQMD) in California (Ferguson, 1990a). The SCAQMD's TRO, Regulation XV passed in 1988, was a comprehensive program requiring all employers with 100 or more employees to implement plans outlining how their sites would increase average vehicle occupancy (Giuliano and Wachs, 1992).

Further national legislation in the 1990s under the Intermodal Surface Transportation Efficiency Act (ISTEA) and follow-on Transportation Equity Act for the 21st Century (TEA-21) have provided a national funding source for states and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. The latter act (TEA-21) had set aside $8.1 billion in funding over the six-year life of the act (USDOT, 1998).

Another environmental factor identified by Cornell University is that approximately one acre of green space is consumed for every 80 to 100 parking spaces, and that increased paving leads to increased runoff into underground water supply (Cornell, 1996). The impact of parking on a university with 20,000 parking spaces is therefore approximately 200 to 250 acres of green space, which means 200 to 250 acres less area for the natural habitat of the area and associated impacts on the water supply for both human population and the natural habitat. Likewise, the impact of 1.2 million miles of additional paved roadway plus additional widening of roads over the last 40 years has also had a staggering affect on the natural environment.

In terms of accessibility, while increased road capacity has lagged behind increase in travel, Americans still are able to travel farther and faster than ever before. However, the ability to travel far and fast does not translate into mobility for all. The young, old, poor, and handicapped are worse off now than prior to the proliferation of the automobile because they are not able to travel as far and as fast as the remainder of the population (Ewing, 1993a). According to the Florida Department of Transportation, approximately 37% of all Floridians in 1992 were transportation disadvantaged (Ewing, 1993a citing FDOT, 1992).

Alternatives to Single Occupant Commuting

Because of the negative impacts associated with the large increases in automobile travel, especially single occupant commuting, American government at all levels have begun improving alternative methods to single occupant commuting and making transportation systems more efficient. Improvements in alternative transportation and other transportation systems have typically been considered part of supply-side strategies that increase the carrying capacity of the transportation system (Downs, 1992). Alternative transportation improvements include building and improving public transportation systems, including bus and rail transportation and associated infrastructure (shelters, stations, vehicles, etc.), and providing infrastructure that supports bicycle and pedestrian transportation such as dedicated bicycle lanes, sidewalks, bicycle racks and lockers, and landscaping and architectural improvements that make this type of travel more pleasant and convenient. Many governments have started planning, programming, and providing infrastructure that supports a combination of transportation modes where people can efficiently change from one mode of transportation to another, and ensuring that alternative transportation is provided more efficiently between home, work, and commercial locations along the transportation network. Gainesville, FL, the host community of UF is one community that has included this within its comprehensive and long-range transportation planning process.

Additional supply-side strategies that improve the efficiency of the transportation system include (Downs, 1992):

- Coordinating the timing of traffic signals
- Using television monitoring systems to spot accidents and then quickly dispatching repair vehicles to remove accidents
- Installing ramp signals to control the flow of traffic entering major highways
- Providing electronic devices and signals that provide real-time information on current traffic conditions
- Altering street patterns from two-way to one-way traffic and parking patterns to provide improved traffic flow and less impact from vehicles entering or leaving roadside parking spaces, and

- Building high-occupancy vehicle (HOV) lanes that can only be used by vehicles with more than one occupant (and sometimes more than two occupants).

The difficulty with supply-side remedies is that they typically require a lot of funding to accomplish, especially rail transportation systems. Back in 1976, the annual cost to operate the San Francisco Bay Area Rapid Transit (BART) system was over $146 million, which included annualized capital costs (Webber, 1976). While most capital and operating expenses of transportation systems are not as expensive even by 2000 standards, they do require a significant amount of public funding to operate. The problem with the strategies specifically mentioned above to improve the efficiency of the transportation system is that they also benefit solo commuting. In addition, Downs (1992) also argued that supply-side remedies, regardless of specific strategy, will always fall victim to "triple convergence" due to the emergence (or reemergence) of solo commuters from other routes, times, or modes of travel to take advantage of the increased capacity of the roadway system in the jurisdictions that the improvements were made.

Transportation Demand Management

With limited availability of public funds and the limited effectiveness of supply-side remedies, many governments have implemented demand-side remedies to reduce the demand for solo commuting during peak congestion periods while using existing transportation infrastructure. The Washington State Legislature specifically stated, "The capital and environmental costs of fully accommodating the existing and projected auto traffic on roads and highways are prohibitive. Decreasing the demand for vehicle trips is significantly less costly and at least as effective in reducing traffic congestion and its impacts as construction of new transportation facilities such as roads and bridges to accommodate increased traffic volumes (Ollivier, 1993 citing Washington State Legislature, 1992)."

Demand-side remedies, or transportation demand management (TDM) strategies, attempt to modify personal travel behavior to reduce the demand on the roadway system without having to perform costly expansions of the transportation system (Ferguson, 1990a and Zupan, 1992).

This involves implementing policies and strategies that overcome the advantages that commuting alone has gained over alternative methods of commuting. Costs of implementing TDM strategies are typically small in relation to supply-side strategies, and results can be achieved relatively quickly in contrast to major supply-side projects (Giuliano and Wachs, 1992). However TDM responds to changes in transportation supply, thus the two approaches are complementary rather than competing (Ferguson, 1990a) and are often considered in conjunction with one another. TDM is not very popular, especially in the political arena because it affects a person's almost total freedom in his or her decision-making process, it attempts to limit people from using their personal vehicles, which is generally considered a necessity in today's American society and a symbol of prestige, and it often involves increasing the cost of commuting alone. In order for TDM to be successful, cooperation is required from many different private and public groups within the community (Ferguson, 1990a), most having needs, interests, and agendas that do not include reducing automobile use.

TDM has been broken down into different classifications and strategies by various authors and groups. The Organization for Economic Cooperation and Development (OECD, 1994) identified five strategy classes for TDM, and include land use and zoning, telecommunications substitutes, traveler information services, economic measures, and administrative measures. Erik Ferguson (1990a) identified a matrix for TDM, which included specific aspects of travel based on the four-step urban transportation planning process (trip generation, distribution, mode choice, and route selection), specific objective of the travel aspect (eliminating the trip entirely, shifting to a less congested trip destination, shifting to a higher occupancy mode, and shifting to a less congested route or time period), and specific implementation strategies for land-use and transportation. Jeffrey Zupan (1992) identified six specific TDM strategies – alternative and flexible work schedules, ridesharing, parking management, preferential treatment for high-occupancy vehicles, congestion pricing, and land-use and zoning.

There is considerable overlap between individual strategies, with certain elements of one strategy occurring during the implementation of another strategy. This is very common among economic, administrative, and legislative measures, where one or all of these tend to be used when implementing the other TDM strategies. Economic measures emphasize benefits and costs

in money or time for implementing TDM, while administrative and legislative measures involve the requirement to implement TDM (i.e. voluntary or involuntary) and the administration of the particular strategy. Often, economic measures are an implementation tool of legislative and administrative measures, while administrative measures may be a result of legislative measures. The next sections discuss all of the various strategies, organizing them from legislative and administrative, to economic, to the other strategies that physically provide the reduction in use of solo-occupant vehicles.

Legislation and Regulation

Legislation and regulation can encompass any government or employer mandate to implement TDM. Theoretically, regulations could include restrictions on the use of private automobiles, or restrict the purchase of gasoline to even or odd days as was done during the energy crisis of the late 1970s. However, direct regulation of travel behavior has been avoided in America as economically and politically unjustifiable (Ferguson, 1990a citing Witheford, 1989) and even unconstitutional depending upon how the legislation is written. Therefore, employer regulation on travel has more freedom to restrict certain types of travel; however, only in certain types of travel or use of transportation facilities. For example, some universities have instituted auto-restriction zones, or have not allowed or limited the number of incoming freshmen and new employees to park on campus. One example is the University of California, Davis, which implemented auto-restriction zones in 1995 – an outer ring that allowed automobile, bicycle, and pedestrian movement, a middle ring that restricts vehicular traffic, and inner ring that restricts both vehicular and bicycle traffic (Flynn, 1998 citing UC-Davis, 1995). UF has also implemented auto-restriction zones.

Legislation has often taken the form of Trip Reduction Ordinances (TROs) with the goal of reducing congestion, improving air quality, and reducing energy consumption (Vigna, 1987 and Ferguson, 1990a). Examples of locations that have implemented TROs, and legislation that has required TROs were previously mentioned in the Literature Review. The Washington State Commute Trip Reduction (CTR) Law passed in 1991, requiring nearly 900 employers in the state's eight most populous counties to develop and implement plans to reduce solo commute trips, is another good example of a TRO (Lagerberg, 1997). Legislation has also taken the form

of growth management regulation that limits development to only what can be absorbed by a community including existing or planned transportation infrastructure (Ferguson, 1990a citing Harris, 1988), and zoning ordinances that implement land use policy and specify maximum allowable densities of development. Land use and zoning are discussed further in the next section.

Land Use and Zoning

Land-use and zoning strategies attempt to minimize the length and quantity of vehicle trips by channeling growth into higher-density, compact activity centers of mixed land uses (residential, retail/commercial, office, and recreation) thus making alternative modes of transportation, including transit, bicycle, and pedestrian uses more practical and efficient. Transportation goals, objectives, and policies are thus met through the comprehensive planning and land development process. The following elements were suggested as effective land use and zoning techniques (OECD, 1994, 26-27):

- incorporate mixed, compatible land uses.
- create places of work near residential districts.
- encourage development of recreation, employment, and retail land-uses near residential districts.
- encourage transit compatible development on vacant parcels in developed areas near transit stops and routes
- discourage auto-oriented uses near transit stops
- increase residential densities along existing bus routes and stops
- increase employment densities in activity centers, and
- explicitly plan for pedestrian and bicycle access to activity centers.

Over the past 40 years, development of residential neighborhoods and commercial districts have become very spread out and auto-oriented, thus a significant amount of infill and redevelopment is required to meet these land use goals (OECD, 1994). Therefore, reductions in congestion will not be realized as quickly as other TDM methods. A further difficulty is that infill and redevelopment of low-density areas is often met with strong resistance from existing residents

and neighbors, thus providing compact development within new developments would be more politically feasible that infill and redevelopment (Downs, 1992). Even with these potential difficulties, the potential for success of land use and zoning was shown in a 1988 study of the impact of various land-use strategies on suburban mobility in Middlesex, Somerset, and Mercer Counties in New Jersey. The model within this study projected a growth of 30% in population and 54% in jobs in the tri-county region between 1988 and 2010, leading to a growth of about 1.8 million vehicle trips and 300,000 morning peak-hour VMT based on current trends. The overall conclusion of the study was that higher-density, mixed-use centers with alternatives to commuting alone would have a dramatic impact on reducing the growth of single-occupant travel. The specific results of the model identified two land-use scenarios that would cause a dramatic avoidance in single-occupant travel (33% - 61%), peak hour VMT (32% - 44%), and travel time (44% - 68%), as compared to the existing trend if either land-use scenario was not implemented (USDOT, 1992).

Two additional ways in which land use and zoning strategies can be used as TDM strategies are for regional and local ordinances to either offer or require developers to implement TDM programs or provide site amenities (or both) as conditions for development approval instead of requiring developers to expand roadway capacity to meet projected demand caused by development. The theory is that developers may be more receptive to these conditions as they are often less expensive than providing additional transportation infrastructure, including parking facilities. Site amenities include cafeterias, ATM machines, convenience stores, dry cleaning, gymnasiums, child-care centers, and other facilities and services that an employee may need to use during the day. When provided on-site or close by, site amenities do away with the need to make additional non-home-based-trips during the day (Davidson, 1994).

Administration of TDM Programs

TDM programs can be administered in two ways – through a municipal or regional Transportation Management Association (TMAs) or through individual employers. TMAs are public or private organizations (or combination of both) that assist employers with administering TDM or trip reduction programs and individuals with commuting options available to them. Services that TMAs typically provide are assistance with matching people that live in proximate

home locations into carpools, dissemination of transit schedules and information, and assistance with transportation management plans. Certain TMAs also provide assistance with parking management and setting up alternative work schedules, shuttle services, incentives for carpooling and vanpooling such as guaranteed rides home, and evaluation services to determine the effectiveness of employer TDM and trip reduction programs. In general, but especially with the private sector, TMAs offer assistance with TDM program elements on the basis of least cost and greatest gain. By the end of 1989, there were 55 TMAs located in 14 different states across the United States (Ferguson, 1990a). Gainesville, FL had a TMA into the early 1990s.

While assistance from TMAs is beneficial and useful, employers can administer TDM programs without assistance from TMAs while performing most to all of the same functions. In some locations, TROs require (or at one time required) the provision of a fully trained employee transportation coordinator (ETC). Regulation XV of the SCAQMD required the full training and certification of ETCs by the SCAQMD (Ferguson, 1990b).

Incentives and Disincentives

Incentives and disincentives are supporting strategies and policies that make TDM and alternative transportation more appealing and acceptable than commuting alone. TRO's normally require individual work sites to employ incentives that reduce the number of people that commute to work alone (Modarres, 1993 citing Bhatt and Higgins, 1989 and EPA, 1990). Incentives work on the side of making TDM and alternative transportation strategies more attractive, while disincentives specifically attempt to make solo commuting more difficult. Both can be monetary or non-monetary as discussed below.

Examples of incentives include provision of monetary subsidies, discounts on local merchant items, offering the use of employer-owned vehicles for work and sometimes commute-related purposes to employees that use alternative forms of transportation, providing discounted or free fuel and maintenance to pooling vehicles, preferential treatment for high-occupancy vehicles on highways (such as dedicate travel lanes for HOV use) and at individual work sites (preferential parking locations), extra vacation time, free use of bicycle support equipment and provision of showers and lockers at work, and even government supported tax breaks or fee reductions for

companies that institute trip reduction methods or locate within close proximity to high frequency transit routes (OECD, 1994 and Munnich et al., 1997). Another popular incentive is for an employer to provide a free or subsidized emergency rides home during the work day if an employee or his or her family member becomes ill, or guaranteed ride home if an employee is required to work overtime (Olliviere, 1993 citing Park, 1992). Examples of methods in which an employer can provide or assist with emergency or guaranteed rides home include subsidizing local taxi or transit service, using company-owned fleet vehicles, or by forming backup car or vanpools (Olliviere, 1993, citing Polena and Glazer, 1991).

Examples of disincentives include expensive penalties for non-compliance with TROs (such as SCAQMD's imposed $25K per day against employers failing to comply with Regulation XV – Giuliano and Wachs, 1992), increasing gasoline taxes, and pricing transportation infrastructure based on the impact that its usage has on the transportation system, other users of the system, and the rest of the physical and natural environment. The latter disincentive can be implemented using congestion and parking pricing, which will be discussed in greater detail below, and is based on economic theory that if a valued good is under-priced, demand will exceed and outstrip supply (NRC, 1994). Unfortunately this situation has been occurring over the last 40 years, as people are generally only taxed on the gasoline that they use. The exceptions are the various toll roads dispersed throughout the county, and in certain parking locations in busy downtown areas when normally free parking areas are quickly consumed. However, if the total social cost of transportation - including freight and personal delays, accidents, and air and water pollution was reflected at the gas pump, a gallon of gas would be anywhere between $4.50 and $5.50 per gallon (Ewing, 1993a citing Renner, 1988).

Congestion Pricing

One difficulty of increasing gas taxes is that it does not specifically account for peak congestion periods when the transportation system is stressed the greatest. However, pricing the transportation system during congested times attempts to have the reverse effect of triple convergence - encourage people to switch to less crowded alternative routes, shift travel to another time of day when roads are less crowed, or even better take public transit or join a carpool (Wachs, 1995). The percentage of people commuting alone would decrease, usage and

efficiency of high occupancy transportation systems would increase, and revenues from people still commuting during peak congestion periods would increase enabling the transportation system at all levels to be better funded (NRC, 1994). A study conducted for San Francisco and Los Angeles indicated that a $2.00 - $3.00 per day congestion fee would result in a two to five percent reduction in total vehicle-kilometers of travel (VKT), a two to four percent reduction in total trips, and a fifteen to twenty percent reduction in peak-period travel (NRC, 1994). Similarly, a $3.00 congestion fee would generate about $3 billion annually in the greater Los Angeles Area (NRC, 1994 citing Small, 1992).

The concept of congestion pricing is already performed by various industries including utility and telephone companies that charge higher rates during peak loading of the system, and even restaurants and movie theaters that provide "early-bird" or matinee discounts (Wachs, 1995). In the transportation industry, airline companies charge different airfares and some fixed-rail systems charge different rates based on day of week and time of day. As far the highway industry is concerned, technology has improved to where toll collection techniques are rapid, inexpensive, and reliable (NRC, 1994). Yet congestion pricing is still not common in America, even with transportation economists and planners in wide-scale agreement that the social costs of transportation should be levied more directly against those that impose them, would lead to more efficient use of existing roadway capacity, make public transit more economically competitive with commuting alone, and produce revenues that could be used for various public purposes, transportation or otherwise (Wachs, 1995).

The main reason for public disapproval and hesitancy is that congestion pricing involves a change in the way travelers and commuters are charged for transportation services. As already indicated, the public is used to being charged for using the system through gas taxes (although public transportation is generally charged on use), which still leaves travelers almost total freedom to choose where and when to drive. Additionally, many argue that since they already pay gas taxes, congestion pricing constitutes paying twice for the same roadway usage. In terms of equity, many people argue that congestion pricing is unfair to various groups, including hourly-wage workers that have little schedule flexibility such as working mothers with child-care responsibilities, and low-income workers that have little discretionary income. Some groups

such as truck drivers protest congestion pricing since their business is using the road, even though congestion delays have a tremendous impact on the delivery of their freight. (Wachs, 1995)

While many that challenge congestion pricing on the basis of equity often have little concern for the well-being of the poor or working women when considering other policy initiatives, the arguments against congestion pricing do have some merit. When considering congestion pricing schemes, the government needs to research, forecast, and monitor where the most efficient levels of pricing would occur in order to ensure a proper balance between not having any impact on congestion and clearing certain roadways completely, as well as the potential impact of pricing on redistributing traffic patterns (Wachs, 1995). Since one of the main objectives of congestion pricing is to reduce commuting alone, alternative transportation options should be available, usable, and reliable. Also, programs can be designed to compensate lower income groups through redistribution of revenues and lifeline tolls. Congestion pricing can be used to offset regressive gas, sales, and property taxes (NRC, 1994), and peak period tolls can be reduced to low-income travelers which was implemented successfully at the San Francisco-Oakland Bay Bridge toll (Munnich et al., 1997).

Parking Management

Parking management strategies combine incentives and disincentives with certain elements of congestion pricing, where employers, governmental agencies, or other property owners at destination locations develop, administer and enforce the policies and strategies. Incentives with parking can include offering preferential parking locations close to work for those that carpool or vanpool, and offering subsidies that encourage the use alternative forms of transportation. Otherwise known as parking "cash-out", employers can provide a monetary incentive equivalent to the parking subsidy that they would have otherwise provided in free parking (Ollivier, 1993 citing Taub, 1987) to all commuters, or only to those that use alternative transportation methods. Often times employers use subsidies in conjunction with charging for on-site parking - the major parking management disincentive to commuting alone - thus people that use alternative forms of transportation can pocket the subsidy while people that commute alone by automobile have to return the subsidy as a parking fee (OECD, 1994).

Charging for on-site parking closely follows the logic behind the economic theory stated in the congestion pricing section, especially those employment areas where the demand for parking is far greater than the parking supply. Universities with large populations and high demand for parking often charge for on-site parking, especially when space to build extra parking is limited or new buildings are required to be constructed on existing parking lots (Olliviere, 1993 citing Van Dyke, 1991). In order for on-site parking charges to affect commuting throughout an entire metropolitan area, they would have to be implemented everywhere therein (Downs, 1992); otherwise, travelers would still commute alone while skillfully avoiding parking in areas that charge fees. Similarly on a smaller scale, on-site parking charges will be more effective if coordinated with off-site parking restrictions. Potential negative effects of increasing parking charges on university campuses are that employees and students may protest, and parking may spill into surrounding areas unless off-site parking restrictions are coordinated with increased parking charges (Ollivier, 1993 citing Dowling et al, 1991).

Charging for on-site parking is considered one of the most effective methods of reducing solo commuting (Ollivier, 1993 citing Zupan, 1992, Ferguson citing Bhatt and Higgins, 1989, and Downs, 1992); however, it remains the exception rather than the norm. Various examples in the literature have identified employer provision of free parking to employees as the overwhelming standard:

- Willson, 1992 – 92% of cases studied.
- Giuliano and Wachs, 1992 – as high as 90%.
- USDOT, 1993 – Two-thirds of businesses with 100 or more employees surveyed in the state of Washington.

According to various reports in the literature, the direct result of employers and other commercial centers providing an abundance of free or inexpensive parking is that commuting alone has increased dramatically over time while at the same time discouraging alternative forms of transportation (Ollivier, 1993 citing MacKenzie et al, and Shoup, 1982). However, national policy, developmental standards, and common business practice have lead to increased availability of inexpensive and convenient parking for employees and consumers alike. While

parking facilities are certainly not free - consider the cost of constructing parking facilities previously mentioned in the Literature Review, as well as operation, maintenance, administrative costs to larger employers for managing parking programs (issuing parking decals and enforcement), and the added cost to society in congestion, safety, and environmental impacts (Shoup, 1995) - owners of parking facilities are able pass on their cost for providing parking to consumers through higher costs of goods and services, while keeping cost for parking either free or at low expense in order to retain or attract business. Additionally, national taxing laws have enabled employers to subsidize parking for their employees and write a portion of the expenses off, while subsidies paid to employees for alternative transportation programs have been considered taxable income (Willson, 1995).

Another interesting point is that over time, it became standard for new development to overestimate the actual parking needs of their facilities, thus leading to a widespread oversupply of parking that ultimately became the standard by which future minimum parking ordinances were developed. The results of which were to provide a national system of free and oversupplied parking that is typically seen in suburban shopping malls and office parks (Shoup, 1995). Similar to congestion pricing, as employers and commercial centers have become more auto-centric, people have become more resistant to paying for parking (with the exception being those areas that traditionally have charged for parking such as major downtown centers and central business districts).

Alternative and flexible work schedules

Alternative and flexible work schedules attempt to reduce the number of days a person commutes to work, or shift a person's commute times outside of major congestion periods. Two examples are compressing the amount of days a person works during a one or two week period by allowing a person to work longer days yet still meet their 40 hour work-week commitment, and moving a worker's start and end work time to either before or after the morning and afternoon rush hour (Zupan, 1992). Compressed workweek schedules usually involve 4 ten-hour hour days during a one-week period (4/40), or 8 nine-hour days plus 1 eight-hour day over a two-week period (9/80). The 4/40-schedule theoretically saves one work-trip every five days, and thus reduces the commuting to work of an individual by 20%. The 9/80-schedule

theoretically saves one in ten total work trips, thus reducing work trips by ten percent. An example of moving of a person's start and end work times outside of the peak congestion period is moving an 8:30 AM to 5:00 PM work schedule to 12:00 PM to 8:30 PM. A cumulative effect of many people doing this can be to reduce the amount of commute trips within normal peak congestion periods, but it would not reduce the total number of commute trips since a person would still work five days per week. The result may thus reduce peak hour congestion, but not improve overall environmental conditions.

Telecommuting

Telecommuting attempts to reduce work trips by enabling employees to work at home, or allow shorter commute trips to satellite work centers closer to home. Conducting work at home can include everything from telephone conversations, computer applications, faxing, on-line and modem connections to servers at work, and possibly even teleconferencing. Teleconferencing can often times alleviate the need for long business trips because meetings are capable of being recorded live in various locations around the world. Equipment costs enabling telecommuting and teleconferencing would generally be borne by the employer, thus technical and financial capability of the employer is a limiting factor. However, "one forecaster estimates $23 billion could be saved annually in transport, environmental, and energy cost if there is a 10 – 20% increase in activities done through telecommuting instead of physical transport (OECD, 1994, 30-31)." Whether or not this type of savings would actually occur, money saved through less traveling could potentially be reinvested into telecommunications substitutes. On the other side, telecommuting may increase local travel because people have to travel to teleconferencing centers.

Ridesharing

Ridesharing is the consolidation of two or more people into one vehicle for private transportation purposes, and includes carpooling and vanpooling. Carpooling generally consists of 2 to 4 passengers (including the driver) in an automobile, although the number can be higher in larger-sized vehicles. Vanpooling operates in the same manner as carpools, but the capacity can be as high as 15 passengers. Therefore, vanpooling has a greater capability of transporting more people in fewer vehicles, but also greater issues related to coordination. As the focus of this

research paper, carpooling is traditionally defined as sharing the ride to work in a private motorized vehicle (Ferguson, 1994), typically as a means of sharing driving responsibilities and reducing travel expenses related to work. However in recent years, carpooling and vanpooling have played important roles in TDM, trip reduction, and employer rideshare programs (ERPs). According to Downs (1992), ridesharing has the potential to reduce morning peak hour trips between three and thirteen percent. According to Ewing (Ollivier, 1993 citing Ewing, 1993b), ridesharing incentives can reduce daily vehicle commute trips by five to fifteen percent. However according to Batchelder et al (Ollivier, 1993 citing Batchelder et al, 1983), carpool programs may divert more transit riders than single automobile drivers.

Difficulties and Trends in Carpooling

According to Erik Ferguson (1997), carpooling emerged as a dominant form of work-related travel in World War II when material shortages dictated a somewhat more sparing use of private vehicles. Carpooling reemerged in the 1970s during the OPEC oil crises when the price of motor fuel substantially increased and the availability of fuel substantially decreased. According to the National Census Bureau, carpooling was approximately eighteen to twenty percent of total work-related trips throughout the 1970s (Ferguson, 1994). However, this percentage dropped dramatically throughout the 1980s. By 1990, carpooling declined to 13.4% while average vehicle occupancy (AVO) for work trips declined from 1.3 persons per vehicle in 1977 and 1983 to 1.14 persons per vehicle in 1990 (Ferguson, 1997). In the 1995 National Personal Transportation Survey (NPTS), AVO was roughly the same as 1990 but carpooling as a percentage of work trips was only 11.1% (Hu and Young, 1999). According to the American Housing Survey (AHS), carpooling fell to around 11% of all work related trips in 1989 and 1991, down from 13.8% in 1985 (Ferguson, 1997). According to the 1990 NPTS from which much of the statistical data identified below was derived, carpooling was 16% of total work trips (Ferguson, 1994). While differing reports have identified different specific figures, there is no arguing that carpooling as a percentage of total travel to work has decreased dramatically since the 1970s. While this has occurred, the drive alone percentage of travel to work between the 1970s and the 1990s increased from below 60% to around 80% (as previously indicated).

Some of the reasons given in the literature for the sharp decline of carpooling and increase of solo commuting to work have been the reduction in the real price of motor fuel, the combining of non-work related trips with work trips, the increase in female participation in the labor force, the decentralization of America's urban form into a less dense and more dispersed society, and increasing family incomes, education levels, and auto availability. Erik Ferguson evaluated these claims using 1990 Census and NPTS data. Between 1980 and 1990, the average price of gasoline declined 45% nationally. During the same time period, use of carpools declined by 32%. On initial inspection, it might seem that the reduction in gas prices has an almost one-to-one relation with the decline in carpooling; however, this does not explain the fact that the real price of gasoline grew by 64% yet carpooling slightly declined in the 1970s (Ferguson, 1997). Combining the 1970s and 1980s (1970 to 1990), the real marginal cost of motor fuel fell by 34%, which accounts for an overall 10% fall in the real price of gasoline and a 36% increase in fuel economy of American cars. The marginal cost of motor fuel does thus ranks second as a determinant of recent declines in carpooling (Ferguson, 1994 and 1997).

The combining of non-work related trips with work trips is often referred to as "trip-chaining." Commuters drive alone to work because access to a vehicle before, during, and after work is necessary to perform basic activities in a more modern and complex society. These activities include shopping, buying meals, picking up dry-cleaning, visiting the post office and bank (or ATM machines), and a variety of other activities. Working women tend to make more frequent stops than men because of their greater child-related responsibilities (Davidson, 1994), and according to the 1990 NPTS (Ferguson, 1994) women participation in the labor force increased by 27.5% as a percentage of the overall labor force (from 36% to 46% - Ferguson, 1994). However, the 1990 NPTS also indicated that 19% of working women carpooled while only 14% of working men carpooled. Closer analysis indicates that almost twice as many women participated in household-based (HH) carpools where participants lived in the same household (12.3%), as compared to women in non-household-based (Non-HH) carpools where participants lived at different home addresses (6.8%) and men in HH carpools (6.9%). While women were more likely to form household-based carpools, men were slightly more likely than women to form Non-HH carpools (7.1%).

Regarding the decentralization of American society, one of the main arguments is that "carpool formation may become more difficult as development densities decline and trip ends disperse in multinucleated urban, suburban, and exurban areas (Ferguson, 1997, 360)." This is slightly countered by the arguments that relatively long trips are most efficient since time spent gathering participants in one vehicle is relatively small compared to the overall travel time (Zupan, 1992), and that commuters less than five miles or twenty minutes from work have a difficult time carpooling since time spent picking up and dropping off participants is significantly high compared to overall travel time (Ollivier, 1993 citing Batchelder et al, 1983). According to the 1990 NPTS, carpooling tended to decrease the further out commuters had to travel to about 11 to 15 miles and then started to increase with increasing distance (Ferguson, 1994). Very short trips (1 to 5 miles) and very long trips (over 31 miles) tended to have the greatest percentage of carpooling. In terms of population density, carpooling tended to increase in metropolitan statistical areas (MSA) with increasing densities up to 5,000 to 7,500 people per square mile before beginning to steadily decline. In highly dense areas over 10,000 people per square mile, transit began to dramatically increase while drive alone percentages dramatically decreased. In rural and non-MSA areas, carpooling decreased with decreasing population density to about 625 people per square mile and then started to steadily increase (Ferguson, 1994). Overall, it appeared as if areas with less than 200 people per square mile and between 4,000 and 10,000 people per square mile had the greatest incidence of carpooling. Gainesville has an average population density of just over 2,000 people per square mile for the entire municipal area, making it an area not very conducive to carpooling based on national density figures; however, UF is a very good candidate for carpooling based on its location within the City boundary (trips within 1 to 5 miles) and its student and employment size.

In terms of other demographic characteristics from the 1990 NPTS, carpooling tended to occur more frequently in families in lower income categories, with carpooling increasing substantially as family incomes fell further below $30,000 per year. However, the incidence of carpooling remained relatively constant as incomes increased over $30,000 per year. Carpooling was highest among the lowest education levels while decreasing with increasing education level, and was higher among Blacks and Hispanics with both races having well over 20% of work trips as carpools while Whites only had around 15% of work trips as carpools. Carpooling also

increased as household size increased but decreased with increasing number of available household automobiles. Between 1969 and 1990, the average household size fell from 3.16 to 2.56 while the number of available household automobiles increased from approximately 1.35 to 1.77. The average number of automobiles dropped almost one whole automobile per person, from 2.34 to 1.45. Taken in combination, the decrease in household size and increase in auto availability appears to be the greatest factor in the decline of the carpool (Ferguson, 1994).

Using 1990 Census and NPTS data (some of it mentioned above), mathematical models were performed to rank the causes of the decline in carpooling, including both HH and Non-HH based carpools. The percentages indicate how accountable the individual causes were in reducing the incidence of carpooling, while the percentages in parenthesis indicate that the causes led to an increase in carpooling (based on the model). Table 2.1 summarizes the results (Ferguson, 1997):

Table 2.1 – Ranking of causes for the decline in carpooling (1990 analysis)

Rank	Cause	Overall Percentage	HH	Non-HH
1	Decreasing HH size and increasing auto availability	38%	35%	47%
2	Decline in real marginal cost of motor fuel	34%	30%	38%
3	Increasing educational attainment and age of population	24%	18%	31%
4	Lifecycle and lifestyle characteristics*	9%	17%	-8%
5	Urban form and trip distance	0%	4%	-2%
6	Ethnic diversity and poverty**	-5%	-4%	-6%
	Total Percentage	100%	100%	100%

* Includes increasing female participation in labor force, increasing single person households, and decreasing percentage of child population to overall population.
** Incorporates increases in population below poverty level from 10% in 1970 to 13% in 1990, and increases in Blacks, Hispanics, and other ethnic groups as a percentage of the overall population.

Additional popular beliefs about potential limitations and consequences of carpooling include the following:

- Carpool formations are largely limited to people whose schedules are rigid. (Ollivier, 1993 citing Zupan, 1992).
- At universities, usually nonprofessional campus employees are conducive to ridesharing because their schedules are more specific, while students and faculty have difficulty with ridesharing because their schedules are flexible. (Ollivier, 1993 citing Roark, 1981)

- The inconvenience and dependency on strict schedules, the need to have car for work and household errands, and the desire to maximize savings in commuting time are significant problems of converting solo drivers to carpooling. (Ollivier, 1993 citing Giuliano, 1992)
- Carpooling can lose effectiveness when members change addresses, and ridesharing will decline at worksites unless management supports an active program to find new members. (Ollivier, 1993 citing Batchelder et al, 1983)
- Use of company-owned or fleet vehicles for carpooling may be a good alternative where employee residences are not densely clustered, but they may not always be available for convenient use and will cause an increase in fleet maintenance and insurance costs. (Ollivier, 1993 citing Batchelder et al, 1983)
- The need for park and ride lots for ridesharing may conflict with need for parking with transit riders if space is limited. (Ollivier, 1993 citing Zupan, 1992)
- Vanpooling requires sacrificing even more flexibility than carpooling; however, the issue of compatibility is often less than with carpooling. (Ollivier, 1993 citing Zupan, 1992)

Employer Rideshare Programs (ERPs)

Starting in the 1970s but evolving and increasing in the 1980s and 1990s, ERPs have been adopted to counteract the increasing trends in solo commuting by making it more costly to commute alone and more attractive, cost effective, and convenient to rideshare. ERPs are similar to and can even be considered a subset of TDM because ERP strategies used to reduce solo commuting are generally TDM strategies; however, ERPs do tend to focus mostly on encouraging ridesharing rather than other forms of alternative transportation and demand management. Elements of ERPs may include some or all of the following (Ferguson, 1990b):

- Designation and sometimes formal training of an employee transportation coordinator.
- Special or specific funding for ERP staff and administration.
- Dissemination of information to inform and assist with ridesharing and incentives.
- Personalized matching assistance, or ridematching.
- Direct ridesharing incentives, including subsidies and guaranteed rides home.
- Parking pricing and other supply control measures.
- Alternative work hours.

Previous studies have found that larger employers are more likely to offer ridesharing help and direct ridesharing benefits to their employees, and receive direct ridesharing benefits such as reduced parking requirements and improved employee productivity (Ferguson, 1990b). A study of various employers with employees ranging from below 100 to over 2,000 in Southern California conducted by Commuter Transportation Services (CTS), Inc., the largest single ridesharing agency in the United States in 1985, determined that staff expenditures per number of employees generally decreased with increasing firm sizes; however, drive-alone rates were consistently ten to eleven percent lower for employers over 100 employees that offered personalized matching assistance versus employers that did not offer ride matching, and drive alone rates decreased significantly and carpool rates increased significantly as staff expenditures increased per employee. Overall findings of the study concluded that combinations of ERP components rather than individual strategies may provide the greatest overall impact at the lowest possible cost, that personalized matching assistance should be one of those components in a great majority of those cases, and that direct ridesharing incentives are not effective, at least where free parking is the norm and not the exception (Ferguson, 1990b).

Other studies have looked at what is important from the perspective of employees in order to determine specific strategies and incentives that will cause the greatest incidence of ridesharing. One example was a survey on employee knowledge of high occupancy vehicle modes, information delivery preferences, and general interests performed by the Bellevue, WA Transportation Information Center (Michalak et al, 1995). The survey evaluated overall responses, as well as responses of employees in households earning below $20,000 per year and above $40,000 year. Results of the survey were that 69% of employees were unfamiliar with available carpooling and vanpooling programs. About 24% of the respondents indicated they would be moderately to very likely to rideshare if programs were readily available, including almost 39% of respondents earning below $20,000 but only 8% of respondents earning above $40,000. About 34.5% indicated they would be moderately to very likely to rideshare to or home from work on an on-demand or flexible basis. Guaranteed rides home were the most important ridesharing feature followed by saving time over current mode and saving money over current mode. Ninety percent of respondents earning less than $20,000 indicated that saving

money was moderately to very important, while only 65.5 of respondents earning over $40,000 indicated a moderate or greater importance. In terms of ridesharing safety features, respondents indicated that pre-screening participants, previously meeting participants, previously knowing participants, and participants being co-workers was at least moderately important 54%, 44%, 44%, and 37%, respectively. Respondents earning less than $20,000 annually had a response rate of between twenty and thirty percent higher than those earning over $40,000. Last, over 50% of respondents indicated at least a moderate likelihood to carpool with special parking privileges, if given full compensation for expenses, and with special discounts on downtown businesses, while only 20% of respondents indicated a willingness to carpool if given up-to-the-minute traffic information. While low-income people were twenty percent more willing to switch if given up up-to-the minute information, they were much less comfortable with using technology based methods (Michalak et al., 1995).

Performance Monitoring and Evaluation of TDM Strategies

Performance monitoring and evaluation of TDM (and ERPs) can be determined based on level of effort or cost associated with implementing strategies, or success achieved with the results of the implementation, or a combination of both. Success may be measured based on the difference between changes in actual travel characteristics before and after implementation of a program, or between actual performance with TDM and anticipated performance without TDM. Levels of success can also be determined based on site-specific or regional goals (Ferguson, 1990a). Previous evaluations have shown the regional impacts of TDM to be slight or negligible (Ferguson, 1990a citing Urban Transportation Monitor, 1988). However, evaluations of TDM impacts across activity centers, towns, and municipalities have been larger (decrease in solo commuting from two to eighteen percent) and across individual work sites even larger (generally from five to forty-eight percent, Ferguson, 1990a citing Kuzmyak and Schreffler, 1990). The best markets for TDM have been in areas with greatest traffic congestion and air pollution. As with ERPs, comprehensive TDM programs that identify groups of compatible incentives may have greater impacts than specific types of incentives offered in isolation, although measuring impacts of separate strategies is difficult to quantify (Ferguson, 1990a). One example of a separate strategy or incentive that has been difficult to quantify its effectiveness is guaranteed

rides home. Most administrators believe it contributes to the success of overall TDM program; however, there is little to statistically support or reject that GRH encourages ridesharing (Ollivier, 1993 citing Polena and Glazer, 1991).

Specific evaluation methods for TDM programs include direct observation, revealed preference surveys to capture information relevant to individual decision making, stated preference methods to evaluate scenarios that are different from current situation and whether or not strategies or services would actually be used by significant numbers of travelers, and organizational sampling that measures effectiveness of policies across many organizations (Ollivier, 1993). Changes in employer modes split – the percentage of employees that travel alone, rideshare, use transit, or non-motorized forms of transportation to commute to work – or comparisons of mode splits of employers in the same area without TDM are the most common measures of effectiveness for evaluating TDM programs. However, mode split measures have difficulties with the variability of day-to-day travel and estimating changes in regional traffic delays (Ollivier, 1993). Other measures of effectiveness of TDM programs and strategies include the effect on traffic congestion in terms of level of service and average daily traffic, effect on peak period traffic, effect on VMT, effect on trip generation, effect on average vehicle occupancy or ridership, and effect on vehicle emissions (Orski, 1991).

TDM evaluation methods have tended to lag behind TDM implementation methods. TDM areas that have had little formal evaluation include the effect of work schedule changes and flexibility on transit and ridesharing including whether or not savings in VMT from less work trips is lost to non-work trips, the effect that TDM can have on areas that levy impact fees since fees are based on ITE trip generation rates and the proposed impact that new development will have on the loading of roadways, and the effect that TDM has on overall travel since work related trips are a minority of all trips. For example in the San Francisco Bay Area, work trips account for only 33% of total VMT and about 25% of total trips on a typical work day (Orski, 1991). Additional problems of TDM programs have been maintaining short term gains over longer term (Ollivier, 1993 citing Ferguson, 1991), and governments or companies doing away with or scaling back on programs that fail to continue to make progress. On the other hand, certain strategies such as land use and zoning take years to show results.

Examples of TDM Implementation and Evaluations

While TDM in the United States continues to be the exception, there are still numerous examples of where TDM has been implemented and evaluated. At the regional level there have been two well documented examples: the Washington State Commute Trip Reduction (CTR) Law and California's (SCAQMD) Regulation XV. The State of Washington's CTR program was initiated in 1991, and required nearly 900 employers with over 100 employees within the state's eight most populous counties with more than 150,000 people to develop and implement plans to reduce drive alone commute trips. Work site plans used a combination of ridesharing and matching, preferential parking, incentives, and flexible work schedules to reduce and eliminate commute trips. Over 350,000 affected and 115,000 unaffected employees had access to these programs. Initial reports from 1995 found that the overall drive alone rate of affected worksites fell from 72% to 68%, a 5.5% relative reduction from 1993. The overall drop in VMT was 6%. Seventy percent of worksites reduced drive alone rates, but only 31% and 18% of worksites met the stated 15% reduction goal of drove alone and VMT, respectfully. Overall transit use and carpooling of affected worksites during this time frame increased by over 23% and nearly 10%, respectively (Lagerberg, 1997).

The overall effect on congestion was to remove 12,000 vehicles daily during peak periods, resulting in a daily savings of 300,000 VMT (Lagerberg, 1997 citing Dodds and McCoy, 1995). Reductions corresponded to a savings of over 80 million miles annually, a significant reduction; however, only 20% of all employees within affected counties were covered by the CTR Law and annual VMT saved was small in comparison to remainder of VMT in all of Washington State. Looking at the results in terms of monetary cost and savings, approximately $7.5 million was spent per annum in public and private costs for administration with a resulting savings to employees of approximately $30 million, or a benefit to cost ratio of 4:1 (Lagerberg, 1997).

Similar to the Washington plan, California's (SCAQMD) Regulation XV required employers with 100 or more workers at a single work location to complete and file a plan outlining how their sites would increase average vehicle ridership (AVR) to the specified levels within one year

of the SCAQMD's approval of plan. The AVR ratio was calculated over a 5-day workweek, accounting for modified workweeks and telecommunication substitutes and applying credits to automobiles powered by clean fuel. Total affected area was 13,350 square miles and applied to approximately 9,000 firms and 3.8 million workers. Trip reduction schemes included a variety of strategies, including free and preferential parking for carpools and vanpools, transit passes, ride matching, site amenities, and promotional activities (Giuliano and Wachs, 1992).

Giuliano and Wachs (1992) evaluated 812 employment sites with plans in effect for at least one year. The study results indicated an AVR of all worksites increasing by 2.7% from 1.226 to 1.259 between year one and year two of implementation. The results were statistically significant, but overall represented a relatively small increase. About 33% of sites had a decrease in AVR between years one and two, while 29% of sites had an increase in AVR between 0% and 5%, 18% increased between 5 and 10%, and the remaining 19% increased over 10%. Placing results in a convention similar to Washington, solo commuting reduced from 75.8% to 70.9% between years one and two, with greatest increases coming in carpools, increasing from 13.5% to 18.7%. Other mode shares such as vanpool, bus, bicycling, walking, telecommuting, and compressed hours had no significant changes in either direction (between 0.5% increase and 0.4% decrease).

A third regional TDM program implemented in Maricopa County, AZ with similar requirements and benefits, and application to almost 260,00 employees and 74,000 students, produced a reduction in solo commute trips of almost 4% for the employees and 12% for the students, while having an accompanying reduction of VMT of 1% and 6%, respectively after one year of implementation (Burns, 1995). A brief analysis from these regional studies indicates that drive alone and VMT rates of participating organizations with regional TDM programs tend to reduce by around five percent, while providing a nice savings of daily and annual trips, miles, and expenses caused by congestion delay. Specific lessons learned from these evaluations included the following (Lagerberg, 1997):

As programs continue to mature, employers will see a decreasing return on investment to influence the commute-mode choice of their employees and will tend to scale back investment in

TDM programs. Tax credits and employer education about benefits received from investments in TDM programs were recommended to balance this concern.

Employers should be allowed to pursue the most cost-effective efforts at their worksites, and include all employees in results analysis regardless of whether they are affected by the trip reduction laws. Employers in Washington not specifically covered by the CTR Law were originally denied credit for investment in unaffected personnel. Also on the basis of employer input, public awareness in TDM programs should be more prevalent, especially since it is an employee's personal choice that ultimately determines mode of travel.

Arbitrary or unattainable goals threaten integrity of law and weaken support. The reduction goals outlined for Washington and California were basically not achieved. This hindered the credibility of the law in eyes of both elected officials and employers. Revised goals that are more attainable should be considered.

TDM programs generally remain separate from transportation and land-use planning. However, success of TDM programs are often contingent upon access to alternative transportation amenities, yet employers move to suburban locations to escape costs associated with constrained transportation systems. It is at these suburban locations where the built environment is more dispersed and tailored towards solo commuting where employers provide the biggest opposition to CTR programs. TDM should thus be considered closely with transportation and land-use planning.

Reviewing individual work sites, table 2.2 on the next page gives some successful examples of TDM programs from the Puget Sound Region (Rutherford et. al., 1994). Solo commute or single occupant vehicle (SOV) mode share of these employers were between 15% and 30% below the average SOV share of employers in surrounding areas.

Examples of parking management as an individual TDM strategy are now provided. Wilson and Shoup (1990) identified five studies of employers that ended the benefit of free parking, four of which were in Los Angeles, CA and the fifth in Ontario, Canada. Prior to the ending the benefit,

the five employers had a drive alone mode share of 66%. After ending the benefit, the five employers averaged a drive alone percentage of only 39%, with the smallest before and after reduction being nineteen percent. A specific example where an employer ended free parking but subsidized ridesharing was Hartford Steam Boiler in Hartford, CT, which began charging $110 per month for employees to park, representing the market rate for the parking spaces the employer leases. Carpools with two persons were charged $75, three persons were charged $40, and four persons or more were charged only $10 - all had the added advantage of splitting the cost. The company drive alone rate was only 40%, compared to a nearby site that had a 63% drive alone rate with free parking (OECD, 1994).

Table 2.2 – Comparison of TDM strategies and mode splits at individual sites

	Johnson & Higgins	Bonneville Power Administration	CH2M Hill	Pacific Pipeline
Business Type	Brokerage	Public Power Agency	Engineering	Book distribution
No. Employees	182	100	420	138
Location	Urban Center	Urban	Suburban Center	Suburban
SOV Percentage	23%	52%	52%	69%
Carpool/Vanpool Share	2%	18%	9%	24%
Transit Share	70%	20%	19%	2%
Surrounding Area SOV	43%	74%	81%	85%
TDM Strategies Employed:				
Parking Charge	$180 / month	$25 - $40 / month Free on-street very limited	$56 / month	None
Preferential Parking	None	None	None	for HOVs
Subsidies/Discounts	$10/month bus	$40/month all employees $15/month bus and carpool	$24/month alternate modes 60% of time	None
Business Trip Motorpool	Yes	No	Yes	No
Alternative Workweek	No	Time off after reach 80 hrs / 2 weeks	9/80 over 2 weeks	No
Flexible Work Hours	8:30am – 4:30pm	8:30am – 3:30pm	9:00am – 4:00pm	No
Guaranteed Ride Home	Employer fleet or Taxi reimbursement	No	Metro-provided taxi	Taxi-reimbursement
Ridematching Services	No	Regional, computerized, on-site	Carpool/Vanpool Posting on-site	On-site posting
Other comments	Tight parking supply	Bike facilities/racks provided	ATM on-site	Tight parking supply

Two companies that used monetary incentives without charging for parking were Union Bank in San Diego and State Farm Insurance in Costa Mesa, CA. Union Bank offered its 315 employees a 100% transit subsidy and as such had a transit share of 36% as compared to 19% for all employers within the CBD. Passes were provided for trolley service between the Bank's leased off-street parking area several blocks away and the office. State Farm offered subsidies for carpools that increased with size of the carpool. Within two months after implementation of the

program, the AVR increased from 1.22 to 1.55, resulting in a 30% reduction in trips (OECD, 1994).

Evaluations of TDM programs have also looked at whether voluntary programs perform better than government mandated programs, cost-benefit ratios as a measure of success, and whether overall trip generation is reduced as a result of trip reduction programs. The Chicago Area Transportation Study and the Metropolitan Planning Organization in the Chicago area determined that trip reduction programs at fourteen organizations, including public and private offices, factories, and institutions, reduced solo commuting by 5.5%. This was attained at an average annual voluntary cost of $34.38 per employee, and incorporated daily costs for implementing CTR and incentive costs paid to employees. When the costs associated with complying with government mandates not applicable in the non-mandated environment were also included, the total annual cost was $67.27 per employee. Thus, elimination of government mandates would reduce cost of implementing trip reduction programs in Chicago by about one-half. In place of mandatory programs, tax incentive schemes and aggressive education programs could ensure the continuation of TDM programs as voluntary programs (Pagano and Verdin, 1997).

While eliminating government mandates on TDM programs may very well be more cost effective in certain circumstances, when mandates are removed so is the requirement for mandatory participation and compliance. When programs are no longer mandatory, there is no longer any absolute way to ensure that employers implement TDM programs even in areas of extreme congestion and poor air quality, especially if employers feel it is not in their best interest to so. However, future TROs may want to consider reducing or eliminating some of the general and administrative requirements for employer compliance in order to make programs more cost effective for them. Public agencies would then be required to step up monitoring and enforcement to ensure that employers would comply with trip reduction mandates.

Another potential issue with removing mandates is whether or not the overall benefit to cost ratio of TDM programs would actually increase. The Mid-Ohio Regional Planning Council's Commuter Assistance Program (CAP), a non-mandated, publicly funded agency charged with

encouraging ridesharing and public transit in the central Ohio area, was evaluated in 1995 to have a benefit-to-cost ratio of 2.6 to 1. The cost of CAP in 1995 was $332.5K, not including air quality costs and other costs not directly associated with measuring CAP's success in reducing solo commuting. Benefits in terms of dollars saved from VMT (approximately 16,000 miles per day), vehicle-trips (about 470 trips per day), and parking cost reductions were determined to be at $869.5K (Al-Akhras et al, 1997). While a 2.6:1 ratio is probably considered a good investment, the mandated Washington State CTR Law produced a better benefit to cost ratio of 4:1, although it was much larger in scope and may have included additional benefits not incorporated within CAP.

In a 1997 study on the effectiveness of TDM, Erin Bard questioned whether transit and ridesharing would have any effect on reducing overall trips originating from households. Results from her model indicated that where employees increased transit use, there was a decrease in two-day household vehicle-trips by about four. However, household vehicle trips were not decreased when employees switched to carpooling. Potential explanations for this result included the need to drive alone to a required to a carpool pick-up point, carpoolers performing car-related tasks upon returning home, and many carpoolers not carpooling daily. In spite of these findings, Bard still indicated that the effectiveness of carpooling should be based on regional transportation goals. Effects of carpooling may move trips to outside of peak times, which would reduce peak congestion but could also increase congestion outside of peak times (Bard, 1997).

Examples of TDM Implementation and Evaluations at Universities

Evaluations of TDM programs at universities have generally involved researching and identifying various strategies and incentives and then reporting changes in mode share or mode split as a result. A majority of reports have tended to focus more on transit and parking elements. A report of California state university campuses indicated that California schools were very successful in improving mobility of non-solo commuting modes, including transit and ridesharing, thus reducing parking shortages. Student initiatives were important in increasing transit, including three campuses voting for free transit to be subsidized by increased student

fees. The results were a reduction in the need for new parking facilities and lessened traffic impact on surrounding communities (Ollivier, 1993 citing Fajans and Fink, 1977). At the University of California, Los Angeles (UCLA), TDM was funded through parking fees and helps subsidize ridesharing, including vanpools to 50%, as well as campus shuttles and bus service to three neighborhoods (Ollivier, 1993 citing Knowles, 1989). Parking was as high as $900 per year with a rate structure that favors two and three person carpools, and there were free ride-matching services and emergency rides home for vanpools (Flynn, 1996). At the Santa Barbara Campus, students within one mile were not allowed to purchase parking decals, but transit and campus shuttle services were paid through student fees, and there was an escort bicycle service at night (Ollivier, 1993 from telephone conversation with parking services manager).

A Master's Project Report from the University of Florida researching transportation policies of over 80 universities nationwide (most over 15,000 students) determined that while merely imposing a daily parking fee has no influence on commuting habits, changes in parking rates lead to significant changes in the level of automobile usage for faculty, staff, and students. Models run separately for faculty, staff, and students indicated that parking fees explain a 40% to 43% of the variation on automobile use a mode of transportation to campus, and that as parking fees increase auto usage decreases significantly level for faculty, staff, and students. Additional findings of the report concluded that universities with higher levels of congestion and competition for parking have significantly lower levels of auto usage, universities with parking restrictions have significantly higher employee congestion and competition for parking, and that universities with transit to student housing have significantly higher transit and lower automobile commuting than where transit is not provided to student housing (Flynn, 1996).

A report from the University of Wisconsin-Madison identified seven universities with TDM programs and identified various strategies of each school, as well as the individual campus profiles - university and host community populations, location, area of property, etc. Advertising was also a key element of all seven TDM programs. Mode shares and splits were identified for four schools, all of which had organized rideshare elements of their carpool programs – University of Washington at Seattle, Cornell University, UCLA, and University of

Minnesota, Minneapolis (Graves, 1993). The first two schools will now be discussed in greater detail.

While the literature has identified programs and performance monitoring at various universities, the University of Washington and Cornell University appeared to have the most comprehensive TDM programs, including ridesharing, while also performing the most comprehensive planning before and evaluations after implementation of their programs. The University of Washington had reached a point in the late 1980s where use of the parking system exceeded 94%, student daily pay lots often spilled over into surrounding neighborhoods, and participation in carpool, vanpool, and transit programs had declined for several years. In 1989, a new physical development plan called for the addition of over 2 million square feet of development, 4,300 new faculty and staff, and an additional 10,000 projected daily vehicle trips. As a result, a new transportation management program was needed to address new growth, and be capable of maintaining traffic at the desired 1983 levels (Williams and Pertait, 1993).

The subsequent U-Pass program was developed with the formation of a task force of Seattle metropolitan planners and university, faculty, staff, and students, and endorsed by the University's Advisory Committee on Transportation (ACT) and local elected officials. U-Pass offered a flexible package of benefits and unique funding approach that had a major impact on reducing traffic and demand for parking. Funding for the program was broken down as follows: 50% from user fees, 30% from parking fees, 12% from parking fines, and 8% from state funding. U-Pass programs included improved transit, circulator shuttle, night ride services, and ride matching services, carpooling, vanpools, bicycle racks, lockers, and routes, reimbursed ride home. Participation in U-Pass was approved at $9 per month for employees and $6.67 for students. The price for parking decals was increased from $24 per month to $36 per month initially, and then to $40 after six months of implementation. Anyone purchasing a parking decal would also receive a free U-Pass to explore the various alternatives (Williams and Pertait, 1993).

After one year of implementation of the U-Pass program, 72% of the campus population participated in U-Pass (74% students and 68% employees). One-year results taken in Oct. 1991 identified a 15% reduction in morning peak vehicle trips and an 8.6% reduction in afternoon

peak vehicle trips. One-year results taken in Apr. 1992 identified a 16% reduction in morning peak vehicle trips and a 10% reduction in afternoon peak vehicle-trips. Parking lot utilization also dropped to below 80%. Changes in mode splits included a decrease in driving alone from 33% to 23%, an increase in transit from 21% to 33%, and an increase in ridesharing from 10% to 11%. While the relative percentage of carpools to the entire campus population remained relatively constant, the total number of carpool permits increased from 708 to 858 (21.2%), and participants increased from 1,653 to 1,932 (16.9%) between Oct 1991 and Oct 1992. The total number of vanpools increased from 8 to 20 (150%), and vanpool ridership increased from 71 to 197 (177.5%) during the same time period (Williams and Pertait, 1993).

Lessons learned from U-Pass included the following (Williams and Pertait, 1993):

- Balanced TDM programs should include both incentives and disincentives. Free or low-cost parking encourages solo commuting.
- Since people can't always commute by the same mode every day, commuting options should be flexible and ensure access to a variety of options on a continual basis.
- Parking fees may be used as a significant funding source, as well as a disincentive for drive-alone use.
- A comprehensive education campaign during the program development stage helps the program gain acceptance.
- Be prepared to meet the demand for services if it is greater than anticipated.

Similar to the University of Washington, Cornell University conducted a planning study in 1989 that projected need for 2,500 new spaces over next 5 years, with 1,300 of these replacing spaces lost to new campus buildings. Financial projections clearly illustrated that paying bus fares and giving discounts on parking to people that would rideshare would save the university a significant sum of money as compared to construction of the new spaces. Therefore, Cornell implemented their Transportation Demand Management Program (TDMP) to defray the additional parking demand. Prior to implementing TDMP, Cornell raised parking fees to raise awareness of the problems with solo commuting. Specific issues addressed to the campus population included the following (Cornell, 1996):

- Building new parking is expensive, encourages even greater traffic flow to the campus, and ignores Cornell's obligation to preservation and responsible stewardship of its greenspace.
- Road construction and maintenance on and around campus is expensive and damaging to the environment.
- The number of single occupant vehicles on the road is growing and the environmental damage is staggering.
- More traffic means roads need to be (built and) widened (and trees hewn down). Every 80-100 parking spaces require one acre of asphalt.
- Proactively relieving peak commuting hour traffic helps to maintain good relations with neighboring communities.
- Concern for the safety of thousands of pedestrians that traverse the campus every day.
- There are hidden costs in operating automobiles - insurance, environmental, depreciation, wear and tear (not just parking).

The implemented TDMP incorporated two main elements as alternatives to full-fee for parking on campus – OmniRide transit program for all employees living in Tompkins County and RideShare, a carpool program that gives discounts on parking fees or even cash rebates to employees that share a ride to campus with other university employees based on number of participants in a carpool and parking location. Employees in RideShare were required to surrender their individual parking permits. About 1,300 next-to-worksite spaces were also converted to fee spaces. An occasional parker program was initiated to enable people that did not purchase a full-time parking permit and that do not use transit or rideshare, to park 10 days for free at the university over a period of 6 months. RideShare participants were allowed to park individually for 10 days every 6 months. Those that were unable to take advantage of OmniRide or RideShare and needed access to their car during the day, and were unable to afford the parking fees could go before the Parking Hardship Review Board and obtain partial or full grants to pay parking fees. Additional support services of TDMP included area park-and-ride lots that could be used by both transit and rideshare groups, a commuter connection classified column in the university newspaper and Cornell's computerized information system, vehicles and staff were

available to take people where they need to go in case of an urgent situation, and pamphlets were distributed to current and new employees that summarize program services and benefits (Cornell, 1996).

Also like the University of Washington, both Cornell and the surrounding communities were involved from the outset of development and refinement of the program. The University worked with Ithaca and Tompkins County planners and transit operators to make commuting by bus and carpool a viable option. These efforts lead to six separate transit operators getting greater federal and state transit assistance due to better utilization of transit capacity. The University also worked with campus governance groups, employee committees, faculty committees, administration, local community groups, and local leadership. Over 80 public meetings held during which the Cornell community contributed insight and recommendations to the program (Cornell, 1996).

One year after implementation, 2,377 fewer faculty and staff brought vehicles to campus each day representing a reduction in solo commuting by 26%, while 1,324 participants participated in RideShare in 631 groups. As a result, 10 million fewer commuter miles traveled each year than before TDMP translating into 417K fewer gallons of fuel and a reduction of carbon dioxide emissions by 6.7 million tons. Emissions of oxides of nitrogen and hydrocarbons also substantially fell. Because of the success of the program, Cornell was recognized with four national and one state award for environmental sustainability and transportation efficiency. In terms of economics, the estimated cost of running TDMP was $500K per year. Even with this cost, the estimated savings was $54K for the first year, $1.156M by second year due to the elimination of the need to build a new parking structure, and $57K per year after that. The actual cost to run TDMP was initially about one-third of the anticipated cost, and even accounting for a 5% increase per year actual expenditures, still did not reach projected annual expenditures by 1996. Because participation was better than expected Cornell only needed to construct 200 replacement spaces at a cost of $850K, thus actual savings was approximately $4 million by 1994-1995 with an estimation of over $112K for every year beyond that (Cornell, 1996).

Chapter 3 Research Methodology

In evaluating the effectiveness of the UF carpool program, the research was primarily conducted on the participants of the carpool program because it was determined that a study of the entire University population would be too difficult to perform during the available time for this research project. Elements of parking and transportation within UF and the urbanized area of Gainesville were also researched and analyzed to determine if these may have had an effect on the performance of the carpool program or vice versa. The specific research methods that were conducted are indicated below. The discussion of how the data obtained using these methods was used to determine specific measures of effectiveness is provided in the Development of Evaluation Measures section of this chapter.

- Field monitoring of reserved carpool spaces.
- Surveys sent to entire carpooling population.
- Spatial analysis of home addresses using Geographic Information Systems (GIS).
- Research of universities with carpool programs.
- Research of historical data on the sales of parking decals at UF and annual average daily traffic within the Gainesville urbanized area.
- Research of UF program requirements and administrative procedures.
- Other direct observations.

The field monitoring of reserved carpool spaces consisted of performing spot inspections in high-demand parking areas within the main campus and Shands Hospital to determine the occupancy rate of carpools and the rate at which vehicles without carpool permits would park illegally in the reserved spaces. These inspections covered approximately 75% of the total number of carpool spaces. Inspections were evenly distributed over various times during the day between the hours of the highest demand for parking – 9:00 AM and 3:30 PM - over the different working days of the week, and were conducted over three-week periods during the Summer and Fall 2000 school sessions. All parking spaces were inspected once for each day of the week during each semester. The results of these inspections yielded occupancy percentages of the carpool spaces that are displayed based on time of day, day of week, and parking location.

A second set of inspections consisted of monitoring the number of people that arrived in each carpool during the morning. The four parking facilities with the largest number of carpool

spaces, two within main campus (Criser Hall and Chemistry Lab) and two at Shands Hospital (Garage 3 Level 3 and 1329 SW 16th Avenue) were inspected three times each during different days of the week during the Fall 2000 semester. The results of these inspections determine approximately how many people per vehicle arrive at reserved carpool locations.

A limitation of the site investigations is that carpool vehicles are often used during the day, yet there is no way to determine exactly how many vehicles were in use during the numerous inspections. This margin of error will be reduced during analysis by accounting for inspections of spaces when they occurred outside of (before or after) a carpool group's identified work hours, when vehicles occupying carpool spaces did not have the required decal (generally considered illegal occupation), and by accounting for the highest occupancy of carpool spaces as applicable to the appropriate evaluation measure. A second limitation is that during morning inspections there was a chance that certain carpool members might have been using a pass to park individually, were sick, on vacation, or otherwise not coming to work for that particular day. The same could hold true for whole carpools that might not have been present during certain days of the week or times of the day. To reduce this margin of error, inspections were varied over different days of the week and times of day for any given carpool space. A third limitation is that even though the total number of spaces inspected was relatively high, the amount of times that each individual carpool location and space was inspected was still very small. Therefore overall trends and trends in larger groups will tend to be more accurate than trends identified in smaller groups. A copy of the inspection forms is attached as Appendix 1.

The survey of carpoolers involved preparing and forwarding mail-back surveys to all of the known participants in the carpool program in order to determine their travel behavior both before and during membership in the program, demographic distribution, opinions of various program benefits and requirements, and potential willingness to continue participating in the program if certain changes were implemented. A copy of the finalized survey is attached as Appendix 2. Because the survey asked various personal questions to University of Florida and Shands Hospital employees, the survey and informed consent protocol was forwarded to the University of Florida Institutional Review Board (UFIRB) for review and approval. On August 11, 2000, the UFIRB approved both items. Minor modifications were subsequently made to the survey

and forwarded to the UFIRB, who provided further approval on September 11, 2000. The surveys were forwarded to all known carpool program members via their campus mail address on September 5, 2000 with responses requested by October 2, 2000. A copy of the informed consent protocol and approval by the UFIRB is attached as Appendix 3.

Two potential limitations of the survey are that the responses may not representative of the carpooling population in certain demographic categories, and that respondents did not accurately or completely fill out the survey due to not understanding [the intent] of the questions or not being willing to answer the questions. Most of the carpooling population data was obtained through records and databases held at the UF Transportation and Parking Services Decal Office and other UF computerized personnel files. A statistical comparison discussed in the Analysis section of this Chapter identifies the extent of representation of the survey; however, there is no specific method to compensate for a lack of representation or inadequate responses other than to identify where they occurred. Another potential limitation of the survey is that a certain percentage of non-response may be due to carpool participants abusing the system. If this percentage is high enough, then survey responses might also not be representative (over-representative) of the population. Abuse of the system has been analyzed from the results of the different evaluation methods to determine if certain groups of non-respondent carpools are at risk for abusing the system.

The spatial analysis of home addresses involved geographically mapping individual home addresses in ArcView GIS version 3.2, including carpool identification numbers and parking locations within the database for each carpool program member. The home locations within each carpool were analyzed geographically to determine their home to work trip distance from UF, and whether or not they were spatially compatible, i.e. within a reasonable commute path as identified in the UF carpool program requirements. The process of mapping home addresses in ArcView was performed using address-matching, or geocoding the locations from Alachua County tax parcel and street address shape files, and from the Florida Geographic Data Library (FGDL) zip-code boundary shape file for home addresses that could not accurately be matched within, or were outside of Alachua County. A major limitation of this method is the inaccuracy of many home locations due to various participants changing home locations, and addresses in

the many outlying towns and rural areas being inaccurately located when placed at the centroid of large zip codes. However, this latter problem of inaccuracy is somewhat mitigated by longer commute distances.

The review of other university carpool programs first involved researching universities that had programs comparable to UF. A message was forwarded to a national list-server of university parking directors. Additionally, some of the literature identified other universities with comparable programs. Overall, thirteen universities were identified and their websites researched for specific carpool requirements, policies, and benefits. Questions were then forwarded to each university requesting clarification and additional information on items such as campus and host community population, available parking, number of people carpooling, restrictions on parking and carpooling, carpool program requirements, benefits offered, results of implementation in reduced parking and traffic, problems encountered and how they address those issues. Based upon responses of forwarded questions, the following universities were analyzed:

University of California, Davis
University of California, Riverside
University of Wisconsin, Madison
Penn State University
Cornell University
University of Minnesota, Minneapolis/St. Paul
University of Pittsburgh
University of Washington, Seattle

A potential limitation of this method is that every university is faced with unique transportation issues, and while each university has implemented similar policies and strategies to mitigate the high demand for parking and traffic congestion, the specific methods used by each university are in some cases very different from others. Also, most of the universities do not quantify the results of their programs. Therefore, it is difficult to quantitatively compare the policies in terms of effectiveness; however, certain qualitative judgments could still be made from a comparison.

The research on historical data on parking at UF and traffic in the urbanized area of Gainesville included researching UF Transportation and Parking Services records of how many permits have been sold to the campus population, the changes in the price of parking over time, and the number of available parking spaces on campus and how those parking spaces were allocated

from the mid-1990s until the present. The CMP was also consulted to determine how many spaces were planned for additional construction and how much the population of the campus was projected to change. Annual traffic count data was obtained directly from documents compiled by the North Central Florida Regional Planning Council, and identified average daily traffic and levels of service for all major roads – state, county, and local – and collector streets in the urbanized area.

Additional research methods included reviewing UF policy (CMP) and administrative procedures of the carpool program to determine whether certain policies and procedures impact the effectiveness of the carpool program. Direct observations from field investigations and data collection from Transportation and Parking Services and other locations also lend some insight as to the effectiveness of program elements and whether certain changes could be successful.

Development of Evaluation Measures

This section discusses how the research methods identified above will be applied to evaluation measures for each of the three perspectives, and to the recommendations for improving the carpool program. A determination of whether the program has been effective is determined qualitatively from the results of the evaluation measures. Prior to providing results of evaluation measures, statistical tests of significance are provided using normal distribution to determine if the survey responses are representative of the population. The following characteristics have been tested:

* Size of carpool
* Home location (city/county)
* Race
* Age
* Parking location
* Distance to work
* Household vs. Non-Household
* Months worked out of year
* Job classification
* Education Level
* Sex
* Full-time status

Because accurate household income and length of participation in the carpool program was not available for the population, the survey could not be tested for representation on these features.

PERSPECTIVE OF THE UNIVERSITY

From the perspective of the University, the following measures of effectiveness have been calculated and approximated where applicable:

- Occupancy rate of carpool spaces
- Average Vehicle Ridership (AVR)
- Average Daily Participation
- Elimination in vehicles brought to campus
- Reduction in excess demand to supply ratio, or oversell ratio
- Loss in revenue generated from sales of parking decals
- Changes in parking and traffic within UF

Occupancy Rates

The occupancy rate is the average percentage that carpool spaces are occupied, and is an indicator of how often the spaces are used by participants. It is determined by calculating the percentage that reserved carpool spaces are occupied by legitimate carpool vehicles and can be represented based on an overall average of occupancy, parking location, and average occupancy during a given time of day, day of week, or even time of year. Because many participants work in shifts outside of normal working hours, such as 5 AM to 1:30 PM or 3:00 PM to 11:30 PM, there were many instances when field inspections would indicate these reserved spaces as being empty even though there was no way to determine whether or not the space was legitimately used for that given day. This is not a concern when analyzing occupancy based on time of day; however, this is a concern when determining if the space was used over the course of an entire day. Vehicles parked in reserved spaces without the proper decal (illegally parked vehicles) provided the same concern as to whether the space was legitimately used for the day. The assumption used in this case is that an illegally parked vehicle occupied an empty space at a given time of inspection, but offered no insight as to daily participation. Therefore, occupancy rates based on time of day account for carpools as being absent when inspections were performed outside of a carpool's normal working hours or when illegally parked vehicles occupy carpool spaces, while day of week or "daily" occupancy rates do not count or exclude those spaces from the calculation. The occupancy rates between the Fall and Summer sessions are also compared.

Occupancy rates based on location are indicated for main campus and Shands Hospital because it is assumed that these two areas have distinct geographic characteristics. Accounting for the impact of time as discussed in the previous paragraph, the occupancy rates for location will be provided in both average time of day and day of week. Additionally, when calculating the average daily participation (ADP) as discussed below, the average daily occupancy rate will be used instead of the average time of day occupancy rate.

Average Vehicle Ridership (AVR)

Average Vehicle Ridership (AVR) is the measure of how many people arrive in each carpool vehicle during any given day. It is determined by adding the average number of people arriving in carpool spaces in the morning to the average number of people that are dropped off at their work location before the carpool vehicle arrives at its reserved space. The former is a calculation of the number of people witnessed arriving at each carpool space divided by the number of vehicles that arrived. The latter is a slightly more difficult calculation obtained from the survey. Respondents of the survey indicated how often they were dropped off from as low as 0 days to as high as 5 days per week. The sum of all of the responses of days dropped off is divided by an average of 5 days per week to obtain an average number of total people that are dropped off per day. Assuming a representative survey, the proportion of the number of people that are dropped off is applied to the entire carpooling population to determine an overall average number of people that are dropped off per day. This number is divided by the total number of carpools in the program to determine an average number of people that are dropped off per carpool. AVR is again determined by adding this figure to the average number of people that arrive at each carpool space.

AVR is compared to the ratio of the total number of members in the carpool program divided by the total number of carpools to determine an efficiency rating. It is assumed that AVR will be lower than the total membership to carpool ratio because participants occasionally commute alone or are otherwise not present in a carpool. Like occupancy rating, AVR is also represented based on work location – main campus and Shands Hospital. However, there may be a problem

with these results if survey responses based on work location are not adequately representative of the population.

Average Daily Participation

Average Daily Participation (ADP) is the measure of how many program members carpool, or at minimum, use their reserved carpool spaces each day. A person that is dropped off at their work location or drives alone but uses a reserved carpool space is thus also considered as participating. ADP is calculated by multiplying AVR with average occupancy rate and the total number of carpools in the program. ADP is compared against the total number of participants in the program to determine the overall efficiency of the program. The average daily occupancy rate is used for this calculation, because it more accurately identifies the occupancy or usage of carpool spaces over the course of an entire day than the average time of day occupancy rate. Still there is the potential for the occupancy rate to be low because carpools may be in use during field inspections. Therefore, ADP calculated from the daily average occupancy rate will be considered a low estimate. The high estimate for ADP will be calculated based on maximum occupancy rates of carpool space usage. The assumption is that ADP will be somewhere between the low and high estimates. ADP is also calculated in terms of location – main campus and Shands Hospital.

Elimination in Vehicles Brought to Campus

This is determined by comparing the number of vehicles currently brought to campus as a result of carpooling with the number of vehicles previously brought to campus as a result of solo commuting. The theory is that people previously commuting alone will now share driving responsibilities with the other members of their carpool, thus causing an overall decrease in the amount of vehicles brought to campus. On an individual basis, there will be occurrences when there is no savings and possibly even an increase in vehicles brought to campus if a person in his or her carpool arrangement ends up driving to campus equal to or more than he or she previously drove alone. However over the course of the entire survey, it is anticipated that there is an overall savings in the number of vehicles brought to campus.

Questions #1 and #13 of the survey are the sources of the data to calculate the savings in the number of vehicles, the former identifying the number of times a person previously commuted alone by automobile per week and the latter the number of times that person now drives into campus per week. If a person indicated that he or she previously carpooled, then there will be no savings attributed to that person regardless of how many times that person now drives because it is assumed that the program did not change that person's commuting behavior. The weekly savings in the number of vehicles obtained from the survey is divided by five to get a daily savings, and then multiplied by the appropriate proportion of survey responses to the population to determine the daily savings of vehicles brought to campus attributable to the entire program. If a person did not answer either question, then that person will not be included as part of the survey for this particular evaluation measure; however (as with all survey questions), a high incidence of non-response increases the chance that the survey is not representative of the population.

Reduction in Excess Demand / Oversell Ratio

This measure identifies the hypothetical reduction in sales of parking decals as a result of the carpool program in two parts. The first part compares the total approximate number of permits that carpool participants would purchase if the carpool program were no longer in existence, against the number of carpool permits that are currently issued. This represents a net savings or avoidance in issued parking decals. The second part compares the current oversell ratio against the hypothetical oversell ratio if the carpool program also were no longer in existence. The specific type of permits that survey respondents indicated they would purchase (general employee, official business, gated, and staff commuter) applied to the overall carpool population are added to the total number of these same permits sold by Transportation and Parking Services documented within their records (most recently January 2000). The reserved carpool spaces are placed back into general use within their applicable lot location, and the ratio of parking permits sold to available parking spaces is recalculated. The ratios of both scenarios – with and without the existence of the carpool program – are compared to determine the hypothetical reduction in excess oversell ratio.

Loss of Revenue Generated from Sales of Parking Decals

Revenue lost as a result of the carpool program is a measure of how much it costs UF to administer the program. It is calculated from the sum of the number of permits that survey respondents indicated they would purchase if they did not participate in the carpool program, multiplied by the applicable price for each type of decal (again applied over the entire carpooling population). This value is then subtracted by [the number of two-person carpools multiplied by $84.00 per two-person carpool permit].

Changes in Parking and Traffic within UF

This section identifies changes in the number of permits sold by Transportation and Parking Services, the prices of parking decals, the total number of parking spaces, and the amount of average daily trips on certain campus roads during the existence of the carpool program from before the program began until the current evaluation. All information was obtained from records held at the Decal Office and the North Central Florida Regional Planning Council, and from within the CMP.

PERSPECTIVE OF THE SURROUNDING COMMUNITY

From the perspective of the surrounding community, the following measures of effectiveness are calculated and approximated where applicable:

- Savings in overall vehicle-trips
- Savings in vehicle-miles of travel (VMT)
- Changes in traffic on various roadways

Savings in Overall Vehicle-Trips

This measure is calculated in a manner very similar to the reduction in vehicles brought to campus. However, this measure identifies the difference between the amount of times a person previously commuted alone by automobile, versus the amount of times that a person either drives to campus or drives to meet other members in his or her carpool group. The theory here is that a vehicle-trip occurs regardless of whether it is to meet another member or directly into campus. While in the previous case a vehicle is saved if it is no longer brought to campus, in this case a

trip is saved if it no longer makes any vehicle-related trip. It is anticipated that fewer vehicle-trips will actually be saved than vehicles brought to campus.

Questions #1, #12, and #13 of the survey are the sources of the data to calculate the savings in overall vehicle-trips, where question #1 identifies the number of times a person previously commuted alone by automobile per week, question #12 identifies the number of times a person drives to meet other members in his or her carpool, and question #13 identifies number of times that person drives into campus per week with his or her carpool. If a person indicated that he or she previously carpooled, there will be no savings attributed to that person because it is again assumed that the carpool program did not change that person's commuting behavior. The weekly savings in the number of trips obtained from the survey is divided by five to get a daily savings, and then multiplied by the appropriate proportion of survey responses to the population to determine the savings of vehicle-trips each day attributable to the program. If a person did not answer any of the questions, then that person will not be included as part of the survey for this particular evaluation measure. This measure only accounts for the one-way morning commute.

Savings in Vehicle Miles of Travel

This measure identifies the number of vehicle miles that are saved as a result of the program, and is also calculated in a manner similar to elimination of vehicles brought to campus and vehicle-trips per day. The number of times per week a person previously commuted alone by automobile multiplied by the distance that person lives from UF, is compared against the distance that a person drives per week within his or her current carpool arrangement, which is the sum of [the number of times a person drives to meet other members of the carpool group multiplied by the applicable distance driven] plus [the number of times that person also drives into campus multiplied by the distance driven from the meeting point to campus]. The difference in this calculation is the number of vehicle-miles that are saved per individual per week, and is converted to a daily savings by dividing by five. As with the calculations for reduced vehicle-trips and vehicles brought to campus, there will be individuals that have an increase in miles traveled as a result of the program if they have to drive out of their way to meet other members and they are the primary driver of the carpool when it arrives on campus. It is again assumed that over the entire course of the survey, the reduction in miles traveled will be greater than the

increases; however, this may not be case if a large number of carpools are widely scattered and members are still making a significant amount of vehicle-trips as compared to before they joined the program. Also, there is no savings if a person primarily carpooled before joining the carpool program.

Correction for Participants That Were Dropped-Off Prior to Joining the Carpool Program

Current participants in the carpool program the were dropped off at UF prior to joining the program have already been considered within the previous measures for determining whether or not they contributed towards a savings or elimination in vehicles brought to campus, total vehicle-trips and miles of travel. However, this group falls into a distinct category where a relative, friend, or neighbor that does not work at UF may have been making extra trips or traveling extra miles out of their way to drop off a current carpool member. Now that the member is apparently carpooling with other UF employees, the relative, friend, or neighbor no longer has to do the extra traveling. These people that do not work at UF and previously dropped off current carpool participants most likely also save vehicle-trips and miles of travel as a result of the UF carpool program. However, this is extremely hard to quantify – a current member that was previously dropped off could have been dropped off by a person that drove them to work and then went straight home or ran errands, a person that worked at an employment site other than UF, or a UF employee in more of a carpool situation. Therefore in conjunction with the two proceeding measures, the number of vehicle-trips and miles of travel that are eliminated as a result of the UF carpool program is corrected using the following assumptions:

- A program member most likely carpooled previously if he or she is currently in a household-based carpool where the other household member is employed at UF.
- If a program member lives far away from UF, he or she was most likely was dropped off by another person on the way to a different employment site.
- A certain percentage of the members are still being dropped off by non-UF employees, or even by UF employees that are not in the member's carpool. This percentage is somewhat proportional to the number of people that do not participate each day.
- The remaining members that previously were dropped off are credited with one vehicle-trip eliminated per day, and an associated savings in vehicle-miles equal to the average round trip distance of those trips from the member's home plus an estimated extra savings for vehicles that still travel to employment sites other than UF.

Changes in Traffic on Various Roadways

This section identifies the changes in annual average daily traffic on various roads adjacent to UF during the existence of the carpool program. Changes on specific roadways and roadway levels of service are provided in tabular format to determine any trends. Roadways not adjacent to UF were not analyzed because it was assumed that traffic becomes too dispersed at that point.

PERSPECTIVE OF PARTICIPANTS OF THE CARPOOL PROGRAM

The effectiveness of the carpool program from the perspective of the participants of the carpool program is mostly obtained from the survey responses and partially from observations obtained during the research process. The survey identified fourteen potential benefits and other factors related to the carpooling program and carpooling in general, and requested participants indicate the level of importance of each in their decision to participate in the carpool program – the level of importance being ranked from least important (1) to highest importance (5). The responses determine which benefits and factors apparently have the greatest and least influence on current participation. Participants were also given the opportunity to offer their own likes and dislikes about the program, which also lends insight to how they view the program. A few responses of importance, likes, and dislikes are represented based on certain demographic trends to determine if certain segments of the population view the program differently than others; however, this type analysis was not performed comprehensively. Other survey questions that may help determine how participants view the program, or certain elements of the program, include length of participation and method of recruitment into the program. These same questions may also provide insight as to whether these elements are effective from the perspective of the University. Observations were mostly obtained from the travel behavior and interaction with the Transportation and Parking Services Decal Office of the general campus population, but were primarily obtained from viewing the behavior of carpool participant during the research process.

ADDITIONAL FACTORS THAT AFFECT PERFORMANCE

Abuse

Abuse of the program is generally considered to occur when employees join the carpool program, yet do not carpool regularly with their group. Likewise, abuse occurs if an employee is consistently driving alone because the other members are using some other mode of transportation. Based on the results of evaluation methods performed from the perspectives of the University, the community, and the participants certain conclusions have been drawn as to the occurrence of abuse of the carpool program, including a couple of groups within the group that appear to be at high risk for abuse. However, no specific analysis was performed to relate abuse of the program to specific causes or specific population groups.

Impact of Carpool Program Administration and University Policy

In this portion of the evaluation, various guidelines and procedures relating to the administration of the carpool program and University policies are analyzed to determine if they have contributed to the effectiveness of the program. Additionally, specific actions taken by the University are also analyzed to see if potential non-compliance with policies and guidelines may be affecting the program. Specific procedures and guidelines analyzed include minimum requirements for participation, compatibility of members in terms of work hours and home locations, awareness and advertising of the program, and enforcement of program requirements by the University. Policies are primarily analyzed from the Academic Facilities, Transportation, and Capital Improvements elements of the CMP.

Geographic Distribution of Home Locations – Reasonable Commute Path

The distribution of home locations using ArcView GIS was primarily analyzed to determine whether carpool groups were meeting the intent of the "reasonable commute path" guideline of the carpool program. A carpool arrangement has a reasonable commute path when carpools do not cross the campus to pick up members, using the criterion identified by the University of Washington, Seattle. For the analysis at UF this criterion was slightly modified so that a carpool commute path would only be considered unreasonable if all members live outside a ninety-degree arc of their designated parking location on campus. The remaining carpools are

considered to have reasonable commute paths. However, an additional group of carpools while within a ninety degree arc are not grouped very well based on the geographic dispersion of their home locations versus the availability of numerous other carpool participants from other locations close to their homes, many within the same housing subdivisions or apartment complexes, or along a relatively linear paths to the University. This group is considered loosely reasonable. Significant limitations of this evaluation method are that the criteria for defining whether a commute path is reasonable is somewhat subjective, while the actual determination of whether or not a commute path is reasonable is based mostly on a visual analysis of carpool arrangements, not on any specific mathematic methodology that would provide more objective, scientific results.

COMPARISON OF POLICIES WITH OTHER UNIVERSITIES

This section summarizes demographic, parking, carpool, and other TDM policies from eight universities that have similar carpool programs to UF. In certain categories where information is provided quantitatively, UF is compared to these other universities. Important differences in policy between the other universities and UF are identified, as well as innovative policies implemented by the other universities that could potentially be implemented at UF. However, what may work very well in urban universities such as Pittsburgh and Minnesota may not work as well at a more suburban university like UF.

RECOMMENDATIONS FOR CHANGES AND IMPROVEMENTS

Recommendations for changes and improvement will primarily be obtained from the methods listed below:

- Review of measures of effectiveness from three perspectives.
- Impact of UF administration, guidelines, and policies.
- Review of policies implemented at other universities.
- Potential flexibility and willingness of participants to continue in the program.
- Other observations and factors.

The results of the evaluation measures and the impacts of UF administration, guidelines, and policies help to identify which policies of the carpool program seem to be working the best and

least. The goal is to try to improve policies that have poor or mediocre measures of effectiveness. However, it may be in everyone's best interest that a certain policy or strategy be dropped from the program. Potential ways that policies could be changed, improved, or even added to UF's carpool program and other supporting transportation programs are generally taken from carpool and TDM programs at other universities similarly situated to UF, as well as from the research literature.

However, while there are probably various options that UF could technically implement, consideration is given on the practicality of whether such changes could occur at UF. The potential willingness of members of the carpool program to continue participating under possible changes identified in the survey is analyzed in terms of maintaining existing participants and possibly attracting new participants. The approximate cost, level of effort, and feasibility of potential changes are also addressed qualitatively. Ultimately, any changes to the program should be in compliance with existing UF and local government goals, objectives, and policies, unless either entity would be willing to entertain a change in such areas, which would require a long, drawn-out process. Any changes to the program should also be compatible with, and not at the expense of other UF policies to reduce demand for parking on campus and solo commuting by automobile, while providing beneficial and useful transportation alternatives to all members of the university population. Final recommendations for changes to the carpool program and related policies at UF are therefore provided based on technical merit as to what could improve the effectiveness of the carpool program, feasibility of implementation, and are grouped based on short and long-term solutions.

Chapter 4 Results and Discussion

This chapter provides the results of the various evaluation measures identified within the previous chapter, and discusses what the results physically mean (qualitatively). The format of this chapter closely follows the outline of the Development of Evaluation Measures section of the previous chapter, with the exception of information specifically relating to the summary of the overall performance of the carpool program, which is discussed within the next chapter.

Demographics

An analysis of demographics indicates that a majority of people within the UF carpool program fall within the following categories: part of three-person carpool groups, female, white, over the age of 35, staff employees, with at least some college education, work full-time (12 months out of year and on full-time status), and live very close or very far from campus. Table B.1 in Appendix 4 shows the complete demographic distribution of the UF carpool population. The results tend to follow the national demographic trends of carpoolers identified within the literature other than age, education level, and household composition. The UF carpool population increases with age until the 35 to 44 age group, while the national trend decreases with age until the 55 to 64 age group. The education level of carpoolers at UF is highest among people with college education, while the national trend is to decrease with increasing education level with less than a high-school degree having the highest percentage of carpooling. Finally, UF has a significantly greater number of non-household based carpools (68%) while the national trend is a higher number of household-based carpools (55%). The differences between UF and the national trends may be attributable to the overall demographics of the UF campus employment population, especially the academic nature of UF as a place of employment containing a relatively smaller number of young faculty members. No tests of significance were performed between UF and national statistics, and no reasoning is readily apparent as to why household carpools would be less in the UF carpool program than elsewhere in the nation. However, it was apparent from observations of numerous automobiles arriving on campus that many people (employees and students) at UF carpool outside of the program, and the majority of these carpools may have been household based.

Comparison of survey demographics to total participation in the carpool program

The overall response rate of mail back surveys was 30% - 628 mailed and 189 returned completed. The response rate enabled statistical analysis using Normal distribution where statistical difference was determined based on a 95% confidence level. There was no significant difference between the survey responses and the population of carpool members at UF for the categories of carpool size, sex/gender, age, months out of the year employed at UF and full-time status, and city and county of home locations (see Table B.1 in Appendix 4). Difference in sex/gender is not considered significant ($Z = 1.65$) because there is no reason to believe the survey would yield a higher result than the population average. Within job classification, only Post Doctoral Associates (PDAs) were under-represented within the survey ($Z = -2.41$). Survey responses were also significantly under-representative of the population for the following categories: minorities, high-school diplomas or equivalent, Shands Hospital parking locations, non-household based carpools, as well as people living within one and within five miles of the their parking location at UF.

Average home-to-work trip distance from the homes of survey respondents to their reserved parking locationwas significantly longer than the average distance of the population ($Z = 2.99$); therefore, it was believed that the survey would have fewer shorter trip distances than the overall average. This was statistically proven for people living within 1 mile or less ($Z = -1.92$) and within 5 miles or less ($Z = -1.87$), although it was not proven for people living within 1 to 5 miles ($Z = -1.08$). Also noteworthy is that the distribution of trip distances is positively skewed for both the population and the survey, where there is a majority of shorter distances but the presence of longer distances causes higher average distances. While these comparisons analyzed trip distance to assigned parking locations, 22.9% of the entire carpool population lives within one mile of the contiguous boundary of UF (surrounded by University Avenue, SW 13th and 34th Streets, and Archer Road, but does not incorporate SW 16th Street, specifically the Shands Administration [1329] Building). Figure 1 in Appendix 4 illustrates the geographic distribution of these homes within one mile of the UF boundary.

Part of the under-representation of the survey appears to be attributable to a relationship between the lack of survey responses by Blacks ($Z = -3.8$) and people with high school diplomas ($Z = -$

3.47). Only 14 out of 105 Black participants in the carpool program responded to the survey (13.3%), while 62 of the 105 Black participants had high school diplomas or equivalent (59%). This is compared to an overall survey response rate of 30%, while the population average of high school diplomas or equivalent was 33.5% but the average of survey respondents was only 21.4%. Additionally, 33 out of 35 participants that work the early 5:00 AM to 1:30 PM shift are Black (the other 2 participants have unknown races), and only 2 of these people responded to the survey.

Another segment of the population that is under-represented, PDAs (only 5 out of 45 responded - 11.1%) appear to have the following relationships:

> Most PDAs were Asian or Pacific Islander (API) - 40 out of 45 of all PDAs or 88.9%.
>
> Most PDAs parked in Shands Hospital locations – 30 out of 45 or 66.7%. Shands parking represents 35.2% of all carpools, but only 26.4% of the survey respondents parked at Shands ($Z = -2.5$).
>
> The average home-to-work trip distance from the homes of PDAs was less than 3 miles from their parking location, while the overall carpool population average was 13.7 miles.
>
> Sixty-four percent of PDAs were part of carpools do not have a reasonable commute path, compared to a population average of below twenty-seven percent.

Even with these apparent relationships, which were not statistically proven, it is noted that Blacks only represent 18% participation while PDAs only represent 7.1% participation within the carpool program. Another segment of the population that was under-represented by the survey are employees that work in University Press – only 1 out of 26 employees responded (3.8%). The average trip distance of this group is below 8 miles (t-statistic = -3.71 when compared to overall population average) and 80.8% of this group (21 out of 26) is part of carpools that do not have a reasonable commute path. An original belief before proceeding with this research was that a good percentage of participants in the carpool program that were abusing the system would have no incentive to responding to the survey. While not proven here, PDAs and University Press employees are suspect for abusing the system based on a relationship between a lack of survey responses, relatively short commute distances, and unreasonable commute paths, which will all be discussed later in this report.

Segments of the population that were over-represented by the survey included whites, people with college education, main campus parking, household-based carpools, and longer home-to-work trip distances, although no relational analysis was performed to possibly determine what caused this over-representation. Other groups that may be over-represented by the survey includes participants that previously carpooled or have been participating in the carpool program for a long period of time, based on the assumption that these people have the greatest interest in the program especially if any changes are proposed. However, there is no way to confirm or deny this theory because this data was only collected in the survey so no population data is available for this group.

While the lack of representation of various demographic factors, both in terms of under and over-representation, or the unavailability of demographic information reduces the reliability of the results of the various evaluation methods when using survey data to explain population data, this research project will still use the survey to represent the population. A variety of categories of statistical difference have been identified; however, the differences though significant were not overwhelming.

PERSPECTIVE OF THE UNIVERSITY

Occupancy Rate of Carpool Spaces

The overall results of spot inspections of carpool spaces to determine the percentage or rate that carpool spaces were occupied are presented in this section. Overall percentages of occupancy were 77.4% accounting for 924 spaces inspected for the Fall 2000 semester, and 73.8% over 884 spaces inspected for the Summer 2000 inspection. Comparing the two inspection time periods statistically, Fall inspections were significantly higher to a 95% confidence level ($Z = 1.78$) with the underlying assumption that occupancy of carpool spaces in the summer would be less than in the fall due to a percentage of participants not being employed (5.6% of the carpool population works under 12 months), and the increased probability that carpool participants are taking vacations during the summer. Not counting inspections of carpool spaces when members were

outside of their normal work hours or when vehicles without a carpool decal occupied carpool spaces, the overall occupancy percentage for Fall 2000 was 81.9% (871 spaces) and for Summer 2000 was 76.3% (845 spaces). This difference was also statistically significant at the 95% confidence level (Z = 2.85). For purposes of further analysis, the Fall 2000 inspection figures will be used since they represent conditions that UF faces for nine months out of the year – August to May.

Inspection results based on peak time of day analysis are indicated in Table 4.1. No inspections took place between 12:00 PM and 1:00 PM because this is probably the most frequent time of day that people are on their lunch break. The overall average of these inspections is 77.4%, the same as previously indicated for general spot inspections. The morning had a higher occupancy rate than the afternoon, especially late afternoon, possibly due to a larger number of morning shift workers and employees occasionally being able to leave work early. Twelve carpools have workers employed from 5:00 AM to 1:30 PM and 1 carpool group works from 6:00 AM to 2:30 PM, while there are only four carpools that start work at 12:00 PM or later. However, comparing the combined morning results to the afternoon results, the morning only has a statistically higher occupancy rate at the 90% confidence level (Z = 1.56) based on the assumption that the morning should yield a higher percentage. When comparing the combined morning to late afternoon results, or early morning to late afternoon results (because early morning has a higher standard deviation than if using late morning), the morning has a statistically higher occupancy rate at the 95% confidence level (Z = 2.17 and 1.82, respectively) again assuming the morning should yield higher occupancy results.

Table 4.1 – Time of Day Analysis, Fall Only

	Morning Before 10:30AM	Morning After 10:30 AM	Afternoon Before 2:30 PM	Afternoon After 2:30 PM
Percentage Occupied	79.6%	79.6%	77.7%	71.7%
Number Inspected	185	270	282	187
Average (all times)	77.4%			

Inspections results based on day of week are indicated in Table 4.2. These calculations exclude carpool spaces when inspections took place outside of a carpool group's normal working hours and when vehicles occupying carpool spaces did not have a legitimate carpool decal. This analysis was used for daily inspections because there was no way to determine whether or not a

carpool space was legitimately occupied during a given day if an inspection occurred outside of a carpool group's working hours, or if a vehicle was illegally parked in the space. The overall average occupancy per day is calculated at 81.9%. Over the span of a week, the daily occupancy rate increases until Wednesday when occupancy is at its highest (87.3%), and then drops off to Friday when occupancy is at its lowest (78.0%). The distribution over the span of the week is almost in a perfect bell-shape.

Table 4.2 - Day of Week (Daily) Analysis, Fall Only

	Monday	Tuesday	Wednesday	Thursday	Friday
Percentage Occupied	79.4%	82.1%	87.3%	82.1%	78.0%
Number Inspected	186	185	183	187	183
Average (all days)	81.9%				

Inspection results based on the two largest areas, main campus and Shands Hospital, are identified both in terms of time of day and day of week analysis. Main campus has an occupancy rate of 74.7% over 558 inspections, while Shands has an inspection rate of 81.4% over 366 inspections based on time of day analysis. A statistical comparison between the two locations indicates that Shands had a higher occupancy rate of spaces at the 95% confidence level ($Z = 2.38$). In terms of day of week (or daily) analysis, main campus has an occupancy rate of 80.2% over 520 inspections, while Shands has an inspection rate of 84.3% occupancy rate over 351 inspections. The difference between the two areas is not considered significant to the 95% confidence level ($Z = 1.54$).

It is noted that both time of day and day of week analysis tends to underestimate the actual occupancy of carpool spaces since they do not account for periodic usage of carpool vehicles during the day by participants – 59.4% of survey respondents indicate they use the carpool vehicle during the course of the work day. However, the frequency with which carpool vehicles are temporarily away from their designated parking space cannot easily be determined.

Average Vehicle Ridership (AVR)

The average number of participants arriving per vehicle, or AVR, is calculated at 2.02, or roughly two persons per vehicle per day. Approximately 1.46 people arrive at each carpool space while 0.56 people are dropped off directly at their work location on average per day. In

terms of location, the AVR for main campus is calculated at 2.09, while for Shands Hospital AVR is calculated at 1.92. Based on the maximum number of people that could arrive in each vehicle per day, the AVR efficiency level for the entire program is 75.7%, while for main campus it is 76.6% and for Shands it is 73.8%. Table 4.3 summarizes the results for AVR.

Table 4.3 – Summary Results for Average Vehicle Ridership (AVR)

	Overall	Main Campus	Shands Hospital
AVR	2.02	2.09	1.92
Maximum AVR	2.67	2.73	2.60
Percent Efficient	75.7%	76.6%	73.8%

The following identifies how AVR was calculated. The 1.46 persons per vehicle arriving at each carpool space per day was obtained by witnessing 256 people arrive in 175 vehicles, within 90 different carpool spaces at four different locations identified within Chapter 3. Because carpools locations were witnessed three times each, many carpools were witnessed arriving two or three different times, which improves the reliability of these results. The 0.56 persons per vehicle dropped off at their work location per day was obtained from a survey response of 38.4 people being dropped off per day from 182 eligible responses. Making the response proportionate to the overall carpool population (621 people), approximately 131 people are dropped off per day. Since there were 233 total carpools at the time of analysis, the average number of people dropped off per vehicle is estimated at 0.56. The 2.02 persons per vehicle number represents a 75.7% efficiency level based upon a 100 percent efficiency level if everyone in the carpool program carpooled every day (621 people / 233 vehicles = 2.67 people per vehicle). The 75.7% efficiency is obtained by dividing the obtained 2.02 AVR by the 2.67 maximum AVR.

The analysis of AVR based on location was performed as follows. The number of people arriving in reserved spaces per day was 1.62 for main campus and 1.24 for Shands based on field monitoring. The number of people dropped off at work locations per day was 23.2 for main campus and 13.0 for Shands based on survey responses. Applying the relative survey percentage based on the number of responses (134 for main campus, and 50 for Shands) to the population (382 for main campus, and 218 for Shands), the total number of people dropped off for main campus is 66 and for Shands is 57. The number dropped off per vehicle is thus 0.47 for main campus (140 carpools) and 0.68 for Shands (84 carpools). Added to number of vehicles arriving

per space, the AVR for main campus is 2.09 and for Shands is 1.92. The AVR efficiency level of 76.6% for main campus was obtained by dividing main campus AVR, by 2.73 people per main campus carpool (382 people / 140 carpools), while the AVR efficiency level of 73.8% for Shands was obtained by dividing Shands AVR by 2.60 people per Shands carpool (218 people / 84 carpools). These results are qualified by the fact that survey responses for main campus are over-represented and Shands Hospital are under-represented, thus AVR and its associated efficiency may not be that exact.

Average Daily Participation (ADP)

This section presents the number of people that carpool, or at minimum, that physically occupy the reserved carpool spaces each day. ADP is calculated by multiplying the daily occupancy rate of carpool spaces by the average vehicle ridership (AVR) and the total number of carpool spaces. As indicated in the Occupancy Rate section of the Results, the daily occupancy rate is still susceptible to excluding vehicles that are temporarily in use, but otherwise present for the day. Therefore, the average daily occupancy rate is used to calculate a low estimate for ADP (81.9%). Two other occupancy rates will thus be used to obtain a [hopefully] more realistic estimate for ADP: the first is Wednesday's occupancy rate (87.3%) since this day had the highest participation, and the second is the maximum occupancy rate of all carpool locations combined (92.6%). The former is considered a middle estimate and the latter a high estimate. The following numbers represent the three levels of ADP:

Low Estimate:	**386 people per day**
Middle Estimate:	**411 people per day**
High Estimate:	**436 people per day**

Since each of the estimates are separated by an even 25 people per day the middle estimate will be considered as the overall average daily participation (ADP), although actual daily participation probably fluctuates in a manner similar to the distribution of the daily carpool space occupancy rate where highest daily participation occurs during the middle of the week and lowest participation occurs towards the beginning and end of the week. Using 411 people per day as the ADP, the overall efficiency level of ADP is 66.2% and is calculated by comparing the ADP to the total number of carpool participants (411 ADP / 621 total participants). The total number of carpool participants per reserved parking spaces per day is thus 1.76 (411 people per

day divided by 233 total carpool spaces) and the associated efficiency is 65.9% (1.76 participants per space per day / 2.67 maximum participants per space per day).

Comparing daily participation between reserved spaces at main campus and Shands Hospital, the former averages 255 participants and the latter averages 141 participants per day. The calculation uses the same formula as overall ADP, using respective AVRs and number of spaces for main campus and Shands. However, Wednesday's daily occupancy rate of 87.3% was used for both locations because there is no statistical difference between main campus and Shands for overall daily occupancy rate (81.9%, Z = 1.54) and Wedensday's daily occupancy rate (87.3%, Z = 1.44). Table 4.4 summarizes ADP, the average participation per space, and efficiency for the entire program, as well as for main campus and Shands. Similar to AVR, main campus has a higher ADP than Shands Hospital, although the efficiency ratings are relatively close. Additionally, the ADP for main campus and Shands does not add up to the overall ADP because there are some carpools that are located in areas outside of these areas.

Table 4.4 – Average Daily Participation, Participants per Reserved Space, and Efficiency

	ADP	People per reserved space per day	Efficiency Rating
Overall	411	1.76	65.9%
Probable Range	386 - 436	1.66 – 1.86	62.2% - 69.7%
Main Campus (average)	255	1.82	66.7%
Shands Hospital (average)	141	1.68	64.6%

Savings / Elimination in vehicles brought to campus

The average number of vehicles avoided or eliminated as a result of the carpool program is estimated at 117 per day. This is obtained from 35.3 vehicles per day being eliminated from campus based on 187 usable survey responses. This number is achieved from 58 people having a net reduction of trips directly into campus, 9 people having a net increase of trips to campus, and 120 people having no net change. Any member that previously carpooled is assigned as having no net change for the days that person previously carpooled. Applying the eliminated vehicles from the survey to the overall population, the total number of vehicles eliminated is calculated at 117 per day. In determining the approximate efficiency of this figure, tables 4.5 and 4.6 are provided. Table 4.5 represents the approximate percentage and whole numbers of current carpool participants that previously used the identified methods or modes of

transportation prior to joining the carpool program. It forms the basis for determining the efficiency as shown within table 4.6.

Following table 4.6, assuming everyone previously drove alone prior to joining the program, the maximum number of vehicles that could be eliminated per day based on the number of participants is 388 vehicles, which is the difference between the total current number of participants in the program and the total number of carpool spaces. Based on this number, the carpool program is approximately 30% efficient in eliminating vehicles brought to campus. When excluding the approximate 191 current members that previously carpooled before joining the program accounting for approximately 91 current carpool vehicles per day, the efficiency improves to over 40% (which may be higher when considering that some people that indicated they were dropped off probably better meet the criteria for previously carpooling, see Chapter 3). When the number of people that previously used modes of transportation other than the automobile are also omitted, the efficiency jumps to 75%.

Table 4.5 – Previous modes of transportation assuming 100% attendance on campus each day

Previous Mode of Transport	Survey (N=188)	Percentage	Population (N=621)
Drive Alone	90.2/day	48.0%	298/day
Carpool	57.9/day	30.8%	191/day
Carpool Vehicles (N=181)	26.4/day	N/A	91/day
Bicycle	15.0/day	8.0%	50/day
Dropped Off	14.1/day	7.5%	47/day
Bus	9.2/day	4.9%	30/day
Walked	1.1/day	0.6%	4/day
Worked at home	0.4/day	0.2%	1/day

Table 4.6 – Efficiency calculations based on the elimination of vehicles brought to campus each day

	Number of Participants	Number of Carpools	Difference	Efficiency based on 117 vehicles eliminated
Original Figures	621	233	388	30.2%
Less 191 previous carpoolers, representing 91 current carpools	430	142	288	40.6%
Less 132 participants previously using other-than-auto modes	298	142	156	75.0%

In terms of practical meaning, these percentages represent how effective the program has been in terms of eliminating potential vehicles based on the total number of current participants and their previous modes of transportation. Because approximately 130 participants used modes of transportation other than the automobile or were dropped off, the efficiency of the program in

terms of the total number of vehicles that could be eliminated is already at a disadvantage. When only considering current participants that previously drove alone, the maximum number of vehicles that could be eliminated per day is approximately 156 assuming 100% participation each day. The calculation of 117 vehicles eliminated per day is 75% of this number. Because the results of ADP shows that participation is around 66% per day, the calculated number of vehicles eliminated per day appears to be relatively accurate (although the actual number will fluctuate each day).

The approximate percentage of vehicles actually eliminated from campus per day based on the total number of vehicles previously brought to campus by current carpool participants (or that would be taken to campus if members did not participate) is also estimated at 30%. This calculation is obtained by dividing the 117 eliminated vehicles by the 389 drive-alone plus carpool vehicles previously brought to campus each day. Removing the 91 vehicles attributed to previous carpooling, the elimination percentage becomes 39.3%.

Reduction in Excess Demand / Oversell Ratio & Loss in Revenue

From survey responses, 153 out of 182 people indicated they would purchase some type of paid parking decal if there were no carpool program. Applied over the entire carpool population, 522 people would purchase a parking decal. Since there are currently 233 carpool decals in circulation, 289 parking decals are eliminated (net) as a result of the carpool program. In terms of reduction in the oversell ratio as compared to the scenario of there being no carpool program, the program reduces the ratio by 0.03 from 1.44 to 1.41 (2.1%) for employees, but only 0.02 from 1.54 to 1.52 (1.3%) for overall parking. See Table B.2 in Appendix 4 for a complete breakdown of how the program impacts the number of decals and the number of parking spaces that would otherwise be available if the program did not exist.

As a result of the reduction in sales of regular parking decals sold by the University, approximately $99,000 in revenue is lost. This figure is obtained by subtracting the figure obtained in table 4.7 ($105,726.00) by the revenue obtained from the sales of two-person carpool permits (79 permits X $84.00 per permit), and represents approximately 3.2% of all revenues from UF Transportation and Parking Services for 1999. According to the Director of Transportation and Parking Services, the only expense of the program is the loss in revenue from

sales of parking decals. However, the reduction in revenue is mitigated somewhat by the fines generated from people without carpool permits illegally parking in reserved carpool spaces. Additionally, there is some expense attributable to administering the carpool program from labor (including towing) and material (office supplies and carpool signs). For purposes of this report, it is assumed that the additional revenues from fines and the cost of administration are approximately the same, and thus cancel each other out.

Table 4.7 – Reduction in decals and loss in revenue as a result of the carpool program

Decal Type	Survey	Population	Unit Price ($)	Revenue ($)
Would Not Purchase	29	99	0.00	0.00
Staff Commuter	15	51	84.00	4,284.00
Orange or Blue	88	300	168.00	50,400.00
Official Business	37	126	216.00	27,216.00
Gated	11	38	522.00	19,836.00
Official Gated	2	7	570.00	3,990.00
	N = 182	N = 621		105,726.00

Changes in Parking and Traffic at UF

This section identifies changes in parking and traffic at UF over the life of the carpool program, from before the program began in September 1996 until the latest date that information was available, January 2000. The oversell ratio for the entire campus population during this time period has decreased by 0.05 from 1.57 to 1.52, a decrease of 3.2%. In terms of whole figures, the number of parking decals sold to the campus population has increased by 652 while the total number of available spaces has increased by 1,027. For restricted employee parking, the oversell ratio has increased by 0.08 from 1.33 to 1.41 (6.0%) while commuter, student, and perimeter parking has decreased by 0.15 from 1.75 to 1.60 (8.6%). Table A.1 in Appendix 4 provides the specific breakdown of sales in decals and changes in allocation of parking spaces between September 1996 and January 2000.

Analyzing these results closer, for restricted employee parking there has been an increase in decal sales by 748, which mostly encompasses gated parking and carpool permits. Non-reserved employee parking has contributed an increase of 158 decals. However, there has been very little in terms of increases in employee parking spaces (+95 spaces), all of which has gone to gated parking, reserved carpool spaces, and to a small degree Shands Hospital. Main campus

employee parking spaces have in fact decreased by 375 spaces. The result has been an increase in the oversell ratio for employee parking, with a slightly larger increase in non-reserved parking (+0.09 from 1.38 to 1.47, or +6.5%). Regarding commuter, student, and perimeter parking, the greatest changes have occurred in the purchase of commuter decals (+612), reduction of commuter parking spaces (-102), reduction in purchase of park and ride decals (-674), and construction of perimeter parking spaces (+990). Overall, there has been a slight decrease in the number of commuter, student, and perimeter parking decals by 87, while the number of spaces has increased by 932.

From Table 4.8, it is also apparent that there has also been a significant increase in visitor, reserved, and non-employee or student parking by almost 1,350 spaces, including disabled, state vehicle, service vehicle, and carpool spaces (which was already included above). Even without carpool spaces indicated in Table 4.8, the resulting increase is still over 1,100 spaces.

Table 4.8 - UF Parking Space Inventory Database (Reserved, Visitor, and Non-Employee/Student)

	Disabled	Carpool	Other Reserved	State Vehicles	Service Vehicles	Motorcycle	Meters	Visitor	Valet	Subtotal (Reserved / Non- Employee / Student)
1996	311	0	570	132	110	0	318	705	0	2,146
Oct-97	372	90	577	135	111	0	293	839	0	2,417
Oct-99	588	229	540	237	283	82	301	1,114	120	3,494
Change	+277	+229	-30	+105	+173	+82	-17	+409	+120	**+1,348**

Summarizing these results, there has been an overall increase in the purchase of decals wholly attributable to employees and commuters, while the number of decals for students and perimeter parking has decreased. There has also been an overall increase in parking spaces on campus but it has mostly been located on the perimeter or allocated to reserved, visitor, and other non-employee/non-student parking. Simultaneously, and somewhat as a consequence, interior main campus and commuting parking spaces have decreased. The effect has been a significant increase in demand within the campus interior, mainly for general employees and commuters (including along North-South Drive, by the Law School and along Fraternity Row), while the demand on the campus perimeter has significantly decreased.

Regarding the change in traffic on campus, data available on the three main traffic corridors on campus – North-South Drive, Hull/Mowry Road, and Radio/Museum Road – has identified a

decrease in mean average daily trips (ADT) by almost 2,300 between 1996 and 1999 (See Table A.2 in Appendix 4), although the actual decrease in traffic is somewhat less because there is some overlap of savings from people driving on a combination of these roads during any one given trip. This decrease cannot realistically be linked to the carpool program because the avoidance in daily vehicles due to the program was estimated at below 120 per day. Additionally, the level of service on these corridors is still primarily E and F (other than the widened section of North-South Drive) and thus generally considered unacceptable, while no information was readily available as to whether some of the decrease in ADT on these corridors was shifted to other roadways on campus, such as Center Drive, Newell Drive, Inner Road, Newell Road, Fletcher Drive, and Buckman Drive (which could have also seen reductions in ADT). The existence of the carpool program has also seemed to do little to curb the trends of increased parking demand on main campus, commuter, and Shands parking, and decreased parking demand along the perimeter of campus, although as shown in the previous section it has somewhat kept employee and overall parking demand from being slightly higher.

Table 4.9 – Changes is Employee and Student population at UF from 1996 to 2000

YEAR	Full-Time ^ Employees (Faculty/Staff)	OPS Employees (Temp)	Shands Hospital Employees	Full-Time Students	Part-Time Students
1996	N/A	N/A	N/A	33,619	5,518
1997	11,670	N/A	N/A	35,591	5,449
1998	11,380	N/A	N/A	36,795	5,308
1999	11,505	N/A	N/A	37,935	5,353
2000	11,811	3,259	5,483	39,331	5,801
CHANGE	+141	Unknown	*Unknown	+5,712	+283

^ Data taken around April of the applicable year given for Full-Time Employees.
* According to Deborah Miller of Shands Hospital Human Resources Department, Shands employment at UF has not fluctuated beyond 200 in either direction.

What may have been more successful at limiting increases in traffic and parking demand on campus is the free use of the Regional Transit System. Table 4.9 shows how the number of students enrolled at UF increased by over 4,000 over the life of the carpool program, yet the overall demand for perimeter and student parking has decreased. However, while employment at UF has remained relatively constant the number of employee decals sold has increased, indicating that employees have become more dependent on their vehicles over the life of the carpool program.

PERSPECTIVE OF THE SURROUNDING COMMUNITY

Elimination in morning vehicle-trips made by participants

The average number of vehicle-trips eliminated as a result of the carpool program is estimated at approximately 62 per day for the morning commute. This is obtained from 15.7 vehicles per day being eliminated from campus based on 188 usable survey responses. This number is achieved from 35 respondents having a net reduction of vehicle-trips, 16 having a net increase of vehicle-trips, and 137 having no net change. Any member that previously carpooled is assigned as having no net change for the days that person previously carpooled. Applying the eliminated vehicles from the survey to the overall population, the total number of vehicles eliminated is calculated at 52 per day. Assuming that an approximate 10 additional morning vehicle-trips are also eliminated because a spouse, relative, or friend no longer has to drive an employee to work per day, the total elimination in morning trips is approximately 62 per day (see table 4.5 for number of participants that previously were dropped off). The 10 additional morning vehicle-trips is estimated based on the analysis that about 70% of survey respondents that were previously dropped off either currently carpool with a member living in the same household, or probably live too far from the University too have previously been dropped off (based on logic stated in Chapter 3). Of the remaining survey respondents that indicated they were previously dropped off, some probably fall within the category of the approximate 200 members that do not participate during any given day and thus are still being dropped off.

Unlike with vehicles eliminated from being brought to campus, there appeared no practical way to determine an efficiency with which trips were saved if everyone previously drove. However from the survey, respondents are currently making 115 vehicle-trips per day thus the entire carpool population makes approximately 378 vehicle-trips for the morning commute. Adding this number to the number of vehicle-trips eliminated per day, an estimated 440 total vehicle-trips were made per day by participants before joining the carpool program. The percentage of morning vehicle-trips eliminated is thus 14.1% (62 eliminated / 440 previous). If we remove participants that previously carpooled from consideration, roughly 120 vehicle-trips, only about 258 vehicle-trips per morning commute are currently being made each day. The total vehicle-

trips originally made per day by non-carpoolers before joining the program was thus approximately 320 per day, and the elimination percentage increases to 19.4% (62 eliminated / 320 previous).

An analysis of trips saved based on county of home location from the survey responses shows that residents outside of Alachua County actually save slightly more trips per participant (0.09 per person per day) than residents inside Alachua County (0.08 per person per day). One might expect carpools originating in Alachua County to save more trips because all carpools originating from Alachua County have three people while carpools originating outside the County are predominately two-person carpools (79% = 158 participants in two-person carpools / 201 total non-County participants). However, a good number of Alachua County residents used modes of transportation other than the automobile prior to joining the program, especially those within close proximity to UF, thus the number of vehicle-trips eliminated from County residents as a result of the program is also significantly affected.

Savings in morning commute Vehicle-Miles of Travel (VMT)

The average number of vehicle-miles of travel (VMT) eliminated as a result of the carpool program is estimated at approximately 800 miles per day for the morning commute. This is obtained from 196.7 VMT day being eliminated from campus based on 179 usable survey responses. This result is achieved from 47 members having a net reduction of VMT, 33 people having a net increase of VMT, and 99 people having no net change. As with elimination in total vehicle-trips and vehicles brought to campus, no net change in VMT is assigned to participants that previously carpooled. Applying the survey responses to the overall population, approximately 682.5 miles per day is calculated as being eliminated per day by carpool participants. An approximate 120 additional morning VMT per day is also eliminated because a relative, friend, or neighbor no longer has to either drive an employee to work, nor drop off the employee at UF while proceeding to another work location, thus providing a total of 800 morning VMT eliminated per day as a result of the carpool program. The 120 additional VMT was obtained by estimating that eliminated vehicle-trips average approximately 8 miles round trip, and that the people that previously dropped off current program members eliminate approximately 40 miles of travel by avoiding UF in their commute to work.

The average of miles eliminated per participant is 1.3 miles per day for the morning commute (800 miles / 621 participants). With an overall average home-to-work trip distance of 13.7 miles per participant, the average percent reduction for trip distance is 9.5% (1.3 miles / 13.7 miles). Removing participants that previously carpooled from consideration (approximately 191 participants per day, see table 4.5), the average miles eliminated increases to 1.86 miles per participant with an associated 13.6% reduction for trip distance. Unlike savings in vehicles brought to campus and total morning commute vehicle-trips, the elimination percentage in terms of actual miles eliminated versus miles previously traveled was not calculated. However, it is still assumed that the elimination percentages provided here provide a comparable measure of efficiency. A comparison of the various results of vehicles, trips, and miles eliminated as a result of the carpool program show how the elimination of vehicles brought to campus by participants has been more efficient while elimination of vehicle-trips and miles of travel have been less efficient – see Table 4.10.

Table 4.10 – Comparison of vehicles eliminated from campus vs. elimination of morning vehicle-trips

	Elimination of vehicles brought to campus per day	Elimination of morning vehicle-trips per day	Elimination of morning VMT per day
Overall elimination	117	62	800
Elimination obtained from survey	35.4	15.7	196.7
Survey Responses (people)	187	188	179
Survey Net Reduction (people)	58	35	47
Survey No Change (people)	120	137	99
Survey Increased (people)	9	16	33
Percentage saved/eliminated (including previous carpooling)	30%	14.1%	9.5%
Percentage eliminated (not including previous carpooling)	39.3%	19.4%	13.6%

An analysis of miles saved versus county of home location from the survey responses shows that significantly more miles are eliminated from residents outside of Alachua County per person – approximately 3 miles versus 0.16 miles per person. Unlike savings in overall morning commute trips, it is expected that residents outside of Alachua County would save more miles per trip because they live further away from the University. However, the relative saving of non-County residents versus average home distance is also much higher than County residents. See table 4.11 for a quick illustration. Once again, this difference in relative percentage between County

and non-County residents is probably caused by fewer County residents being converted from solo driving. It is also probably caused by the fact that 90% of carpool members (149 out of 165) in carpools with unreasonable commute paths originate within Alachua County, and participants within carpools with unreasonable commute paths may have averaged an increase in VMT (perhaps as high as 0.7 miles per person per morning commute trip). This is discussed in greater detail later in this chapter.

Table 4.11 – Illustration of elimination of morning VMT per day based on county of home location

Home Locations:	WITHIN ALACHUA COUNTY	OUTSIDE ALACHUA COUNTY
VMT eliminated per person	0.16 miles per person per day (18 miles / 116 survey responses)	2.84 miles per person per day (179 miles / 63 survey responses)
Average home-to-work trip distance	5.1 miles	30.2 miles
Efficiency	3.1% (0.16 miles / 5.1 miles)	9.4% (2.84 miles / 30.2 miles)

Savings in Traffic in Gainesville

Traffic on major arterials and highways around UF increased by over 16,800 average daily trips (ADT) over the life of the carpool program between 1996 and 1999, and on major local roads by about 1,800 average daily trips. However as with the savings in ADT on campus, the increase in traffic within the community is not quite as great because an increase in trips along multiple roadway segments is often attributable to only one increased automobile-trip. ADT increased by over 5,500 per year for major arterials and highways, and roughly 600 per year for local roads. Largest gains over 1,000 ADT occurred on sections of Archer Road (7,550), SW 34th Street (4,350 and 3,250), SW 23rd Terrace (2,850), SW 16th Ave and W University Ave (about 2,000 each). Largest decreases in traffic over 500 ADT occurred on other sections of University Ave (2,000 and 1,500) and on SW 13th Street (750). Even with changes in ADT, there have been no changes in roadway levels of service. See Table A.2 in the Appendix for a detailed summary of changes in ADT. With the modest elimination in vehicle-trips to campus, overall vehicle-trips, and vehicle-miles of travel the carpool program has probably done very little to impact this growth in traffic either way (up or down). Various other factors that could have impacted this growth in traffic include increasing student and local population, increasing cut-through traffic, road construction and other development projects.

IMPORTANCE OF PROGRAM FEATURES AND BENEFITS TO PARTICIPANTS

Analysis of Importance, Likes, and Dislikes of Survey Respondents

Based on responses from the surveys, the results of how participants viewed various features and benefits of the UF carpool program to their participation in the program are summarized in Table B.4 of Appendix 4. Assuming survey responses are representative of the carpool population, it is pretty clear that the incentives of a guaranteed parking space, priority parking location, savings in cost to park are by far have the greatest impact on participation: 95.6%, 90.5%, and 84.9% of respondents viewed these benefits as very or most important, respectively. While savings in parking price was overwhelmingly viewed as very or most important, savings in cost of gas and vehicle maintenance was not viewed nearly as important with only 53% of respondents indicating this factor as very or most important. This is in spite of the fact that for a large percentage of carpoolers the impact of commuting on their vehicles probably costs more than it does to park on campus. Two other highly important factors related to participation in the program are that carpooling arrangements are currently 76% [very to most] convenient and two-thirds of participants view previously knowing participants as very to most important. The importance of these factors is discussed in Chapter 5, especially regarding active matching of participants based on home location. The relatively high importance of carpooling because it is beneficial to the community is also discussed further when analyzing participant attitudes towards changes in the program.

In contrast to other studies in the literature (especially the Bellevue, WA study), emergency and guaranteed rides home were not as important as various other incentives offered by UF – the former ranking eighth in importance and the latter tenth. In fact, some respondents indicated they were not even aware that the University had such programs; however, many participants may find it easier to obtain a ride from a friend or relative than to go through emergency or guaranteed ride home channels due to the small size of the Gainesville community. The fact that favorable responses were very low for savings in commute time is not surprising; however, many people probably did not consider that they receive an inherent savings in time once they arrive on campus since they do not have to search for an available parking space. Some of the most highly competitive parking areas such as Criser Hall and Chemistry Lab in main campus and Garage 3

at Shands Hospital fill up as early as 7:30 AM, sometimes earlier, and parking in these areas for members of the carpool program is always reserved during the normal work day.

While only a few respondents offered additional factors and benefits of the program that were important to them, some other positive responses included no longer feeling stressed or rushed, they could use the carpool vehicle during the day and still have a reserved space upon return, and that the carpool is available when they do not feel like using their typical mode of transportation (i.e. when the whether is bad). This last response lends some direct credibility to the complaint that people join the carpool yet do not typically carpool. In fact, two additional responses overtly indicated that the person responding was not actually carpooling with their group but just submitting their name so the other person or persons in the group could get a "free space."

Table 4.12 - Dislikes of program indicated by participants

DISLIKE	Responses	DISLIKE	Responses
None	25	Travel to T&P Decal Office to renew / obtain 4-day passes	16
Students & others illegally parking in carpool spaces	13	Lack of enforcement / monitoring, fines too low, having to wait long for tow truck	10
Difficulty / can't find parking elsewhere on campus	8	Not enough one-day passes to park individually (4 passes/semester not enough)	6
Requested parking space not received or moved / does not like parking space	5	2-person decals having to pay to participate / not fair that 3-person decals are free	5
Too many people cheat / take advantage of program	4	County as determining factor for minimum number of participants	4
Poor attitude of Decal Office	3	Incompatibility of individual work schedules	3
Students not allowed to participate	2	Elements of T&P General Rules and Regulations	12

Regarding dislikes of the program by participants, Table 4.12 summarizes the opinions of 102 survey respondents. This question in the survey was also open-ended, thus slightly less than half of the respondents did not even respond with any dislikes. This could mean that respondents had no dislikes of the program, or perhaps they did not feel all that strongly about any dislikes and thus did not indicate a response (although they still might have had some dislikes). Therefore, responses in Table 4.12 are given on a one-for-one basis with survey responses and listed in highest frequency of response to lowest frequency. Responses were collapsed into the categories provided because of the various ways in which responses were worded. Even with the collapse

of responses, the total number of responses indicated in Table 4.12 exceeds 102 because some people responded with more than one dislike. The results are generally self-explanatory.

Most of the people that did respond specifically indicated that they had no dislikes with the program. Some of the more popular dislikes that were indicated include having to travel to the Decal Office more than once per year; illegal parking in reserved carpool spaces (especially by students); not enough enforcement, slow response time of towing, and low cost of fines; not being able to park elsewhere on campus; not enough passes to park individually; and the program's system for requiring payment and minimum number of members per group. It is also noted that while a large percentage of respondents did not indicate illegal parking as a dislike or problem, roughly one space per day was observed during field monitoring as having an illegally parked vehicle, or less than 2% of all carpool spaces monitored.

An additional twelve people indicated dislikes that were not related to the carpool program, but instead campus parking rules and regulations especially regarding the limited availability and having to pay for parking. Specific dislikes included:

- Sales of more decals than parking spaces because fraudulent because everyone should have a space.
- Cost of parking is too high without guarantee of parking space.
- State employees should not have to pay for parking or should receive a stipend.
- Too many employee parking spaces have been eliminated, or not enough employee parking spaces exist.
- Freshmen and sophomores are allowed to park on campus.
- Students place greatest stress on parking system.

The difficulties with the first four issues are that provision of unlimited parking is very expensive, increases traffic and congestion, and is detrimental to the natural and aesthetic environment for reasons discussed within Chapter 2. Additionally the main reason for UF providing the carpool program is to encourage less driving alone to campus so additional construction of parking will be minimized. Charging for parking decals is necessary because it costs money to build and maintain parking facilities, manage the parking program on campus, fund other transportation projects, and to minimize demand in premium parking locations. Freshmen and sophomores are already restricted to only Park and Ride parking locations if they commute, or to Red 3 perimeter student parking. Overall however, students generally do place

the greatest stress on parking with their population being four times as high as full time employees and still growing, while the number of permits and parking spaces available to students is also about 1.5 times greater than employees.

Participation in Program

Table 4.13 – Length of participation in program per survey responses

LENGTH OF PARTICIPATION	QUANTITY	PERCENTAGE
Less than 1 year	34	19.0%
One year or more & less than 2 years	28	15.6%
Two years or more & less than 3 years	60	33.5%
Three years or more up to maximum	57	31.8%
TOTAL	179	100%
Unknown / Does Not Apply	10	5.3%
Average	23.7 months	(S.D. = 12 months)
Median	24 months	

The length of participation in the carpool program also lends some insight into how participants view the program. The longer the participation, the more satisfied the participants. Longer participation also generally implies better retention, a positive sign that the program is able to keep participants. Table 4.13 summarizes the length of participation based upon survey responses, with the maximum being 40 months (May 1997 to September 2000). The average participation length is 23.7 months, or just short of 2 years. The median participation length is 24 months, but a strong majority of the respondents (65.3%) indicated they have been participating in the carpool program for at least that long. This appears to indicate also indicate that participants like the program enough to stick with the program, and that the program retains its participants relatively well. This table does not lend any insight as to how long participants have actually been carpooling before joining the program; therefore, participants may have been carpooling for a great deal longer than indicated within this table. Table 4.5 indicated that approximately 31% of the program population carpooled before joining the program. The average length of participation may also be skewed by employees who are no longer participating, especially if a great number only participated for a short period of time, and a high standard deviation on either side of the mean that covers over one-half of the analysis period.

Summarizing how participants view the program, they appear to feel the program is very convenient and they enjoy the benefits provided, such as reserved and preferential parking locations, free and discounted permits, and 4 passes to park individually. Previously knowing other participants is also very important, as well as carpooling being beneficial to the community although there is some reason not to trust these responses based upon how negative respondents viewed potential changes to the program as discussed within the next section. Participation time in the program is also a decent indicator that members are satisfied with the program. Factors such as saving money in gas and vehicle maintenance, emergency and guaranteed rides home, and savings in time were not nearly as important, even though participants that carpool enough will have less cost and wear on their personal vehicle and realize some savings in time from not having to circle the parking lots to find an available parking space. Most common dislikes of the program were having to travel to the Decal Office more than once per year, illegally parked vehicles in their reserved parking spaces, enforcement, towing, and fines, not being able park elsewhere on campus, and the program's system for requiring payment and minimum number of members per group.

IMPACT OF ADMINISTRATION AND UNIVERSITY POLICY ON THE EFFECTIVENESS OF THE CARPOOL PROGRAM

This section reports how the administration of the carpool program and other University policy may be affecting the performance of the carpool program. Carpool program guidelines and procedure that are addressed specifically include: starting work at same time of day, reasonable commute path, minimum person requirement per carpool, advertising and awareness of program, guaranteed and reimbursed ride home, use of the Campus Carpool Classified web page on the UF Transportation and Parking Services website, enforcement and monitoring of abuse, and other administrative responsibilities. University policies addressed will focus on Campus Master Plan goals, objectives, and policies, mostly related to Transportation Demand Management.

Transportation and Parking Services

An analysis of carpool forms filled out by participants and returned surveys has shown that over 87% of carpools start work less than one hour apart, and end work no greater than one hour apart

(199 out of 228 carpools). Five carpools did not have specified work times. Thus, assuming that work start times (and finish times) within one hour is reasonable, over 87% of the carpools can be considered within the intent of the policy that members must begin work about the same time of day, although this policy does not make it clear what the University considers "about the same time of day." Of the remaining 13% that fall outside of this criteria, roughly one-third of the participants originated from the same household. Thus an additional four to five percent of participants could be considered as meeting the intent of this criterion.

Table 4.14 – Number and percentages of categories of reasonable commute path

	Unreasonable*	Loosely Reasonable	Mostly Reasonable	Total / Overall
Total Carpools	56	38	138	233
Total Participants	165	112	342	621
Percentage Carpools	24%	16.8%	59.2%	100%
Percentage Participants	26.6%	18.1%	55.3%	100%
*Elimination of morning VMT per day	-0.69 miles/person	0.3 miles/person	1.7 miles/person	1.3 miles/person
Elimination of morning vehicle-trips per day	0.07/person	0.09/person	0.08/person	N/A^
Elimination of vehicles on campus per day	0.17/person	0.3/person	0.16/person	N/A^

* Under-represented by survey, most likely affects result for elimination of morning VMT per day.
^ Not calculated for entire population.

A geographic analysis of the home locations of carpool participants on ArcView GIS shows that 24% of carpools (56 out of 233) and 26.6% of participants (165 out of 621) at UF do not meet the intent of reasonable commute path as defined within Chapter 3. The remaining 76% of carpools and 73.4% of participants meet the intent of reasonable commute path; however, 38 of these carpools (112 participants) while within a ninety-degree arc are considered loosely reasonable. Thus the remaining 59.2% of carpools representing 55.1% of participants (138 and 342, respectively) best meet the intent of reasonable commute path. This number is effectively reduced a little more if carpools are considered somewhat unreasonable when one or two people in the arrangement live adjacent to the University boundary, and the other member or members live far away from the University. Nine additional carpools from the most reasonable commute paths fall into this category, twenty-nine total from the entire carpool population. The numbers and percentages of carpools that are not, loosely, and mostly reasonable are presented within

table 4.14, while Figures 2 and 3 within Appendix 4 provides examples of how each category of reasonable commute path is represented geographically.

Based on these results, UF has a greater problem with having participants arranged in carpools with an unreasonable commute path than not beginning work about the same time of day; however once again, the University is not clear on what it considers "reasonable". The problem seems to be manifested mostly in terms of reducing traffic, where reasonable commute path carpools provide almost all of the savings in VMT and unreasonable commute path carpools may contribute to an increase in VMT. This problem does not appear to occur with the elimination of vehicles brought to campus and overall vehicle-trips made, where the loosely reasonable commute path carpools save the greatest amount of vehicles brought to campus per person per day, most reasonable and unreasonable commute paths save the least number of vehicles per person per day, and all types of commute paths save roughly the same number of trips per person per day. The most reasonable commute path carpools are probably lower in elimination of vehicles and total vehicle-trips because approximately 74% of all survey respondents indicating that they previously carpooled before joining the program, and 94% of all two-person carpools fall within the most reasonable commute path category. These results are also presented within table 4.14. However, it should be noted that the specific results for VMT within table 4.14 are probably inaccurate, most likely because carpools with unreasonable commute paths are significantly under-represented by the survey – only 14.2% of participants in carpools that have unreasonable commute paths responded ($Z = -3.65$). On the other hand, the fact that unreasonable commute paths are under-represented by the survey lends some credibility to the belief that much of the non-response of members in unreasonable commute paths could be attributable to abuse of program rules.

An evaluation of minimum carpool standards, especially residence within Alachua County as the requirement for a minimum number of three employees per carpool, can shed some light on whether there are some fairness issues and whether carpooling efficiency can be improved. The maximum home-to-work trip distances of carpool participants living in Alachua County is approximately 30 miles (e.g. Hawthorne). The minimum trip distance for a person living outside of Alachua County to their reserved parking location at UF is only about 12 miles (e.g.

Micanopy). As a result, there is an approximate overlap of about 40 Alachua County residents living 12 miles or greater from their parking location. Even though exact home distances are not always accurate especially for non-County residents, the overlap still considerable. As a result, County residents living further away from UF tend be at a disadvantage because they probably have more difficulty finding two compatible carpool partners than County residents living closer to the University, or than non-County residents who only have to find one compatible partner (especially if that person is a spouse).

The requirement for non-County residents to pay a fee for carpool decals appears fair, considering the decal in most instances is about 75% below market value per person, non-County residents only have to locate one additional member, but if a second additional member is found the decal is free, and two-person carpools provide less of a savings than three-person carpools when properly used. The efficiency of the program may be improved if a two-person minimum standard were adopted because 49 of the 56 carpools that do not have reasonable commute paths would become reasonable (31 of which would be most reasonable), and 29 of the 38 loosely reasonable carpools would become most reasonable. Strict enforcement of the reasonable commute path standard would need to accompany a 2-person minimum standard, and will be discussed further in Chapter 5.

Another minimum standard that is not well defined is the number of days that participants are expected to carpool. This may have some effect on the occurrence of abuse because participants are not told how much carpooling is acceptable. The definition of a minimum number of days that participants are expected to carpool would also probably complement a 2-person minimum standard.

While UF, nor the surrounding communities of Gainesville or Alachua County have any active form of matching carpoolers based on compatible home locations or work schedules, UF does have a Campus Carpool Classified on the Transportation and Parking Services website. It is believed that this Classified has extremely limited to no success in locating and matching carpoolers because no survey respondent indicated ever using this feature to identify other carpool members, and as of the time of this write-up the same five people have remained in the

Classified without any additions or subtractions for four months since the Classified was first monitored in July 2000. According to the UF Transportation and Parking Services Decal Office Manager, carpool participants have also used the emergency ride and guaranteed ride home features of the carpool program very minimally, maybe one person per year. While these features have also hardly been used, the University should probably not give up on them based on the importance identified in the Literature Review and the peace of mind it most likely still affords a large percentage of the carpool program members.

Table 4.15 – Number of participants at various points in time

Month	Carpool Groups	Time (months)
May – 1997	0	0
Sep – 1997	90	4
Sep – 1998	180	16
Jan – 1999	191	20
Sep – 1999	232	28
Jan – 2000	231	32
Sep – 2000	233	40

Regarding awareness and advertising of the UF carpool program, 23.3% of survey respondents (42 out of 189) indicated they became aware of carpool program via University newspaper, circular, publication, or other advertisement, while 13.2% of respondents (24 out of 189) first became aware of program through UF Transportation and Parking Services. According to a study of carpooling in Bellevue, WA discussed in the Literature Review, 69% of all employees were not aware of employer rideshare programs. At UF, 63.5% of all employees within the carpool program were not aware of the program until a co-worker, friend, or neighbor basically tried to recruit them. Additionally, approximately 88% of survey respondents (58 out of 66) that indicated first becoming aware of program, through some form of University publication or advertisement, or via Transportation and Parking Services, have been participating for at least 2 years in the carpool program, while it no longer appears as if brochures, documents, and periodicals (i.e. Rules and Regulations, UF Transportation and Parking Newsletter, RTS Service Schedule, etc.) other than within the UF campus website and Campus Master Plan advertise or even mention the existence of the program. Combined with observations obtained while collecting demographic data over a six-week period during the Fall and Spring 2000 semesters that the Decal Office rarely if ever offers the carpool program as an alternative to employees when they purchase parking decals, it appears that while UF at one time may have actively

advertised the program and recruited participation, they no longer actively do so. This may explain why the carpool program has failed to attract more participation in the last two years of its existence (see Table 4.15).

Nothing quantitative can be identified regarding management, administration, and enforcement; however, the following observations were obtained. Administrative staff in the Decal Office primarily assisted prospective carpoolers register for the program, ensuring that prospective members were full-time university employees and filled out the registration form. The staff then logged personal information into the centralized office computer database and distributed decals and the one-day passes for members to drive alone. The staff also renewed one-day passes for each continuing participant at the beginning of each new semester, and updated changes in carpools when members were replaced. They did not however appear to closely screen or monitor employee working times or reasonable commute path requirements. Final approvals were the responsibility of the Office Manager. Other than the database and associated hard copies, records were not well kept to indicate when a member joined or left the program, or changed address. Often times, addresses were out of date or conflicting with other databases, such the campus phonebook, directory on the internet, and personnel files. Additionally, records were not always up to date as to when a carpool permit might have been revoked or turned in. Once permits were no longer valid, the primary response was to remove the reserved sign at the designated parking space. The associated paper work would not always follow.

In terms of enforcement and abuse, the UF Police Department (UPD) seemed to react relatively quickly with a tow truck if a vehicle was parked in a reserved carpool space without an appropriate decal. However, one person had to remain with the carpool vehicle until the tow truck arrived, unless the police officer gave the carpool permission to park in a non-carpool space. The wait would typically be about 30 to 45 minutes. The fines for illegal parking in carpool spaces are $25.00 for the tow and impound, and $20 for the ticket but the violation has the right to be appealed. There was no set procedure for handling cases of abuse; however, if abuse was determined to occur the reserved sign would be removed, the carpool permit would be revoked and each carpool member would be assessed a $100 fine. Abuse would typically be discovered through phone calls into the Decal Office reporting potential abuse, monitoring frequency of use of reserved parking spaces, occasion random phone calls to participants, and

from reviewing payroll records to ensure a participant was still in the system. During the period of research for this project, at least five carpools were disbanded because of abuse.

Summarizing the results of Transportation and Parking Service's administration of the carpool program, work schedules tend to be compatible and commute paths are mixed with a majority of them being reasonable, but a significant amount also being unreasonable or loosely reasonable. Work schedules and home locations are not screened, thus these results are purely a result of chance and participant desires. Additionally, the carpool program guidelines relating to work times and reasonable commute path, as well as the minimum number of times that participants are expected to carpool per week are all not very specific. Reasonable commute paths result in better traffic savings, but not savings in trips and vehicles although this may be as a result of a lack of change in previous behavior by people that previously carpooled. Approximately 40 Alachua County residents fall within the 12 to 30-mile area around UF where they live further than many non-County residents. As a result, the Alachua County residents living farther away from UF may be at a disadvantage based on the difficulty of finding three compatible members per group. Use of the Campus Carpool Classified on the internet, emergency and guaranteed ride home benefits by participants, as well as recent advertising of the program by UF have been negligible, the latter may have caused a slow down in the enrollment of additional employees. Finally, record keeping, administration, and management appears to be drawing minimal effort, and is closely tied in with other functions of Transportation and Parking Services. Therefore, whatever benefit is being derived is occurring at little cost to the University.

Campus Master Plan (CMP)

The 1994 CMP Academic Facilities Element identified UF as having 37,343 enrolled students with 26,346 as the full time equivalent. The anticipated enrollment by the end of the-ten year planning period (2004) was 45,000 students, with a full time equivalent of 31,748. At the current study year (2000), the 45,000 enrollment figure has been exceeded while the number of full time equivalents far exceeds the projected figure by over 7,500 students. A revised figure for enrollment of students for year 2004 in the CMP update process is over 47,000 students. However, if the University continues to grow as it has in the past four to five years (see Table 4.9), then the 47,000 estimate will again be exceeded. Quickly summarizing, the University has

enrolled more students than planned for, and then raised the figure in the CMP to match actual enrollment. The result has not seemed to affect parking on campus so far based on the lack of increase in total number of parking permits sold to students over the last four years (Appendix 4, Table A.1). However, there may be impact on local roads because traffic has increased significantly between 1996 and 1999 (Appendix 4, Table A.2).

In accordance with the Transportation Element, Objective 3.0 and Policies 3.1 and 3.2, UF was required to implement TDM strategies to encourage the use of alternative modes of transportation and reduce the number of single-occupant vehicles as the primary mode of travel. UF has implemented the following items identified in Policies 3.1 and 3.2:

Reactivated, endorsed and promoted a carpool program with incentives such as preferential parking locations and reduced parking decal fees for participants, although promotion has probably been lacking a little within the past year or two and decal prices are actually free for three-person carpools.

Restricted the availability of on-campus parking for freshmen and sophomores.

Established a transportation fee to fund transportation improvements, such improving the regional transit bus service to off-campus student housing areas and improving shuttle service on campus.

Limited the number of new parking spaces constructed on campus to a maximum of 2,700 net additional spaces by 2004. Most of the new parking is located on the campus perimeter.

Established a trial park and ride program by setting up and express shuttle between the Oaks Mall and the UF campus; however, this program was recently discontinued due to lack of participation.

A Presidential Task Force was also initiated in 1996 to analyze potential parking options, including pricing strategies to make other modes more attractive. The carpool program as

currently implemented complies with this item, as well as Objective 3.0 of the CMP. Additionally since 1995, the UF has averaged an increase of around 5% per year for the price of parking decals (See Table B.3 in Appendix 4). However, parking has not been reorganized, nor has parking price been changed to match the premium parking areas within main campus and Shands Hospital as recommended by the Task Force ($250 per year during 1996). UF has maintained an auto-restriction zone in main campus during the peak hours of the day to prevent the unlimited flow of vehicles through a heavily populated pedestrian area, although the auto-restriction zone does not apply to numerous vehicles such as transit buses, vehicles that can park within the zone, and state and service vehicles. The University now primarily lifts its parking restriction hours at 4:30 PM, but this may be causing increased vehicular congestion from employees leaving at this time and students arriving to take advantage of the lift in restrictions. The University also continues to construct on-campus housing although it appears to remain in proportion to the increase in student enrollment, and offer classes during off-peak hours although the effect on traffic congestion may be minimal with students able to park on campus without restrictions.

UNIVERSITY POLICIES

This section discusses how UF qualitatively compares with eight other universities nationwide that have similar carpool programs, and summarizes various policies and strategies that are used by these universities that could potentially improve the effectiveness of the carpool program at UF. The Tables within Appendix 5 contain tabulated demographic, parking, carpool, and other TDM information associated with these 8 universities.

Demographics

Among the universities within Appendix 5, the number of students ranges from 19,000 at the University of Cornell (Cornell) to 45,000 at the University of Minnesota (UMN), and the number of faculty and staff range from 10,000 at the Universities of Pittsburgh (UPitt), California-Davis (UCD), and Cornell to over 20,000 at the University of Washington, Seattle (UWS), although UPitt also has a 12,000-person medical center within vicinity of the University. Municipal

populations range from around 30,000 at Cornell to around 500,000 in Seattle and Pittsburgh, and metropolitan populations range from around 100,000 for Cornell and Penn State University (PSU) to over 2.5 million for Minneapolis-St. Paul. In comparison qualitatively, UF falls in the upper range of student and employee populations when including OPS and Shands Hospital employees. UPitt was the only university other than UF to also report having an affiliated institution. UF falls in lower range of municipal and metropolitan population, and is probably most similar to PSU, which has a slightly lower population and the University of Wisconsin-Madison (UWM), which has a slightly higher population. UF also probably shares a lot of similar characteristics with Cornell and UCD, which are both suburban in nature. Table 4.16 summarizes how UF compares to the other universities in terms of population demographics.

Table 4.16 – Comparison of population demographics

	Low	UF	High
Employee Population	10,000	Approximately 20,500	Over 20,000
Student Population	19,000	45,000	45,000
Municipal Population	30,000	About 100,000	500,000
Metropolitan Population	100,000	About 150,000	2.5 million

Parking

The amount of parking at the different universities ranges from 4,700 spaces for UPitt to 19,200 for UMN. Four universities have within the range 10,000 to 12,000 spaces. UF is by far higher than any of the other universities in terms of total parking spaces. Parking prices vary significantly at the universities, often based on location from the campus core where parking is premium. The most interior parking prices range from a low of $312 per year for PSU to over $1,000 per year for UMN and about $900 per year for UPitt and UWM. The intermediate prices range from $204 to $800 per year and perimeter parking ranged from $120 to $530 per year, both for PSU for the low price and UMN for the high price. Cornell has a couple of remote parking facilities that are free, including one lot that can be applied for through hardship provisions, but otherwise have their prices within the ranges just mentioned. UWS and UPitt have one primary parking rate at $582 per year and $840 - $890 per year, respectively. The other six universities have some form of tiered-pricing system, with UWM practically having a different price for each parking location. UMN also has daily pay parking garages at $2.75 per day, which translates into approximately $715 if a person parks there 260 days out of the year. It is generally hard to compare parking prices because systems change radically between universities; however, UF

clearly falls below all the universities researched with carpool programs other than it's most premium parking, which costs about $520 to $570 per year and is comparable to Cornell. Otherwise, UF most closely resembles PSU. Table 4.17 summarizes how UF compares to the other universities in terms of parking spaces and annual pricing.

Table 4.17 – Comparison of parking spaces and annual pricing

	Low	UF	High
Parking Spaces	4,700	Approximately 23,000	19,200
Interior or Highest Pricing	$312	$522 - $570	Over $1,000
Intermediate Pricing	$204	$168 - $216	$800
Perimeter Pricing	$120	$84	$530

Regarding parking policy (employees only), all universities limit the number of permits sold on campus other than UCD, Cornell, and the University of California, Riverside (UCR), although the latter university restricts premium and priority parking based on availability. UWM, UMN, UPitt, and UCD use a waitlist system when permits are sold out; UWS, PSU, and UWN have specific lot assignments; and no university appears to have a situation where there is an oversell problem especially in core campus areas, although information was not available from UCR. In comparison, UF only has a waitlist for its most premium parking; otherwise, decals are sold to as many employees that desire to buy them. Temporary employees are restricted to commuter lots. The oversell problem at UF is manifested within its core main campus and commuter areas, and proximate to Shands Hospital when spaces generally reach full capacity early in the morning. Perimeter parking locations also reach capacity during the day (other than perhaps Friday), often as far out as the Law School and fraternity row.

Carpool Programs

In terms of pricing policy for carpool permits, all universities charge some price for carpool permits. PSU, UWM, and UMN allow carpoolers to share the cost of parking, while UCD, UCR, UPitt, and Cornell have a tiered system of charging carpoolers based on number of participants and sometimes location. However, Cornell also offers free permits and even rebates to carpool groups that provide the greatest savings to the University, specifically to carpools that have the most number of participants and carpools that park the furthest away from the campus core. UWS carpool permits are issued free, but only to those that purchase the U-Pass at $44.00

per quarter or $176 per year. In terms of participants, table 4.18 summarizes the approximate number of carpool participation per school per day. The table assumes 100% participation, which like UF probably does not occur. PSU does not typically track formal carpool groups and information was not available from UCR.

Table 4.18 – Daily Carpool Participation at Universities

University	Number of Participants / Daily Participation
Washington, Seattle	4,761 (includes vanpooling)
Minnesota	Over 2,450 (all 1,226 spaces generally used per day)
Wisconsin – Madison	2,050 (including 350 students)
Cornell	1,329
Pittsburgh	750 – 1,000
UC – Davis	722

All universities have dedicated alternative transportation or TDM coordinators except PSU and Cornell. It is unknown if Minnesota has a dedicated coordinator, while Cornell's Transportation and Parking department splits the services of a Transportation Planner with their Campus Planning department. All universities other than Cornell also assist with matching compatible people into carpool groups, five through regional ride-matching services and two through the university itself. While it does not actively match, Cornell uses a rideshare bulletin board within its campus newspaper and TDMP website. All universities also appear to have proactive advertising and awareness programs that attempt to attract the campus populations to use alternative forms of transportation. In terms of specific program requirements, UWS and UPitt require participants to carpool at least three days per week. All universities allow a minimum of two persons per carpool other than Cornell and PSU, which did not specify a minimum number. Additionally all universities allow students to participate in their carpool programs other than UWM and Cornell, although requirements to participate are often different. It is noted that while UWM does not allow students to participate in their programs, approximately 350 students were identified as carpooling daily from 1991 estimations as indicated in table 4.18.

All universities offered various types of incentives other than discounted parking price, although specific incentives varied between universities. All universities offer free or reimbursed emergency rides home although UMN and UWM limit the number of times they can be used, while six of the eight universities offer courtesy, one-day parking permits on occasions when

participants are not able to carpool. The specific number of times participants can use these permits varies per university, from 3 times per year at PSU to up to 24 times per year at UCD (UF is 12 times per year). UWM requires participants to purchase one-day permits, Penn State allows purchasing of one-day permits at $4.00 each after the initial supply is used, and UPitt allows two per semester as long as participants call 24 hours in advance. Reserved parking space policy also varies considerably at each university – all but PSU and UWS had some system of reserving spaces, but UWS permit holders are given priority lot assignments while UWM's policy is unknown by this author. Cornell appears to be the only university that reserves spaces based on individual permits although they are only available to four-person carpools and three-person carpools in perimeter locations. UCD allows carpool groups to select up to two spaces in the lot or lots of their choice; however, all carpool spaces are only reserved until the latest 9:30 AM. The rest of the universities have generalized parking locations that are dedicated for carpool use, while UCR allows carpools to park in regular (non-reserved) preferred or general spaces if all carpool spaces are occupied.

Regarding monitoring of participation, four of the universities indicated they monitor payroll deduction to let them know if a person in their program might have left. Cornell also examines home addresses by hand to check legitimacy while UPitt audits participants every April and revokes permits and issues fines to carpoolers found abusing the program. Only two universities, UWS and Cornell, reported results of their carpool or TDM programs in terms of reductions in solo driving and increases in alternative transportation including carpooling. UMN provided mode split data, while UPitt indicated they perform studies from time to time but no specific information was available from them. Cornell and UMN reported winning energy and environmental conservation awards for their alternative transportation programs.

Other notable transportation and parking features of the eight universities included UWS and Cornell undertaking wide scale education campaigns to raise awareness in the campus population, then entering into a comprehensive, participatory process where student and employee groups and the local community were involved in approving the final TDM programs. UWS and UMN reported using parking revenues to fund other transportation alternatives, while Cornell reported a dramatic dollar savings in not having construct additional parking spaces.

Cornell also offers ten one-day parking passes every six months to all commuters that do not purchase a full-time decal to park on campus, while UCR's flex parking program provides refunds to auto commuters on specific days they do not bring their vehicles to campus. Finally, all universities also appear to have well developed and used public transit systems.

In summary, these eight universities implement a variety of different policies to accomplish the same task – reduce solo driving and increase alternative forms of transportation including carpooling. It is hard to compare specific policies because they vary so much; however, parking availability is sufficiently low enough, prices sufficiently high enough, and the supply of permits sufficiently controlled so as not to cause a major oversell situation where a majority of their parking areas reach capacity and then overflow into perimeter and surrounding areas. Carpool programs generally appear restrictive enough to avoid abuse problems, including charging for carpool permits but having them sufficiently discounted, and having preferential parking for carpools but not necessarily reserved in the same manner usually reserved for Deans and VIPs. The universities also appear to place a lot of effort and finances into their administration, marketing, and advertising to ensure that their alternative transportation and TDM programs have the highest chance for success and that people are aware of the all the transportation alternatives that are available to them. In general comparison, UF parking appears to be relatively higher in quantity while relatively lower in prices, with the sales of parking decals not sufficiently controlled to avoid parking capacity and overflow problems. The UF carpool program provides relatively greater benefit to participants, while being somewhat less specific and restrictive to inherently be able to limit abuse by participants without active auditing by Transportation and Parking Services personnel. The level of effort put forth by UF with their administration, marketing, and advertising is also less, at least in terms of carpooling and transportation alternatives other than transit which is mostly advertised and marketed for student use. A discussion about how many of the policies within these eight universities could be implemented at UF is presented in Chapter 5.

POTENTIAL CHANGES TO PROGRAM
(Based on survey responses)

Based on survey responses, participants indicated they were not very willing to continue participating in the carpool program if UF made some changes to the program to make it a more efficient program. Table B.5 in the Appendix 4 summarizes these responses. The most favorable response was for the University to closely monitor daily participation to ensure carpools were meeting a defined minimum standard. Here the somewhat and very willing responses (34.1%) slightly exceeded the somewhat and very unwilling responses (30.7%). The least favorable response was to alter the benefit of highest to import to participants – preferential parking – where 80.5% of respondents were very or somewhat unwilling to continue participating in the program if parking spaces were no longer chosen but reserved in locations within a ten minute walk or shuttle bus ride from their work location. It is somewhat surprising that the responses were so one-sided against this because participants would still have a reserved space, which was even more important to survey respondents than actual location although not by much. Respondents may have thought that their locations would be moved farther away from their work location than actually intended while asking the question. The next least favorable response was no longer issuing free carpool permits, but charging at substantial discount rates. The overall response was relatively close to most of the other responses (average 2.57); however, the two-person carpool contingent that currently pays a discounted rate for carpool permits responded with 23 somewhat or very willing to continue participating, and only 9 somewhat or very unwilling. This means the three-person carpool contingent was far more against charging for carpool permits than the average indicates, probably due to their current expectations of free carpooling. Also because two-person carpools are currently not free, this question received a relatively large number of non-responses.

Two other intermediate, but primarily unfavorable responses were to continue participating if UF matched participants (50% very or somewhat unwilling) and offered reserved parking for daily or impromptu carpooling with the possibility for a refund on days a person carpooled (38.8% very or somewhat unwilling). Household-based carpools were relatively more likely to indicate not being willing (50 were very or somewhat) versus being willing (15 were very or somewhat). However, approximately 25% of the respondents to both questions did express at least some

willingness to carpool under these conditions, while 36% were neutral on their stance for daily carpooling and 24% were neutral on matching. Even with the generally negative responses, these potential changes appear to have good chance for approval among participants if packaged correctly – i.e. not having to worry about matching two person household carpools if two person carpools become the minimum standard, or offering daily carpooling as an option. Probably the most surprising results were the predominately negative responses to continue participating if UF was to reduce the total number of regular (non-carpool) parking spaces (40.5% very or somewhat unwilling) or increase the price for regular parking decals (48.9% very or somewhat unwilling). The belief here is that participants would not really be less likely to continue participating, but that they are primarily opposed to any further decreases in parking spaces on main campus and Shands, and they are against any form of price increases for parking decals, especially if they are contemplating leaving the carpool program. It has been observed through survey responses, watching the behavior of people at the Decal office, and from the literature that most people are just not use to paying for parking - they do not like it but generally accept it when there is no other practical alternative.

The intent of these questions was to determine how well received and how flexible participants would be to potential changes in the carpool program that would make the program more effective in reducing parking demand on campus and traffic, while also reducing the potential for abuse. Not many respondents seemed to grasp this concept, and taking the responses at face value would generally mean that the University would lose around half, possibly more if any of the changes in Table B.5 were implemented. However, it is the author's belief that the responses were more of a statement by participants that they do not want the University to alter the current program especially since it is very convenient for them now. Most participants will probably not leave the program if one or many of the proposed changes are implemented, other than perhaps participants that are currently abusing the program by either not carpooling or carpooling below the minimum standards, especially if parking conditions remain as restrictive as they are now with demand far exceeding supply, and especially if the University makes parking even more restrictive by further reducing the number of premium parking spaces or increasing parking fees.

Table 4.19 summarizes recommendations by participants to improve the carpool program based upon 83 responses to the open-ended survey question. As with the open-ended question for

dislikes of the program, the responses were collapsed into the categories provided in Table 4.19 because of the various ways in which the responses were worded. Most respondents in this instance left the question blank, thus responses are again given based on whole numbers of responses (not percentages). Additionally, a number of respondents answered this question relating to more than one category, and responses are generally self-explanatory.

Table 4.19 – Recommendations by participants for changes to the program

Recommendation	Responses	Recommendation	Responses
Improve monitoring to prevent illegal parking, tow vehicles quicker & higher fines	12	Allow other methods to renew decals and obtain individual parking passes	10
Increase / don't decrease regular parking spaces, decrease cost of parking, reduce student parking	10	None	7
Provide options for 2-person carpools for Alachua Co. residents (i.e. discounted permits)	5	Provide additional individual parking passes	4
All carpool decals (i.e. outside Alachua County) should be free	4	Don't change program	4
Too many people cheat / take advantage of program	4	Advertise program better / better publicity and awareness	4
Encourage more participation	4	Graduated / variable pay scale for permits	2
Consult other university programs	2		

Actually, the greatest frequency of responses (15) was employees indicating they were happy with the carpool program. Another seven indicated they had no recommendations, while four indicated there should be no changes to the program. Ten respondents basically wanted to increase the amount of regular parking spaces, decrease regular parking price, and reduce or even eliminate student parking on campus. Some popular recommendations directly related to the carpool program were to improve monitoring to prevent illegal parking in reserved carpool spaces, including quicker tows and higher fines, allow other methods to renew decals and obtain the four passes to park individually rather than traveling to the Decal office, provide options for two-person carpools originating within Alachua County, make carpool permits free for all participants, advertise the program, and encourage more participation. Some of the other specific methods of renewal rather than traveling to the Decal office multiple times per year included:

- Allowing renewal over the internet.
- Allowing people to renew individually at T&P, but do not forward decals and individual passes until all members renew.
- Sending decals and individual passes in mail.
- Having decals and passes ready for pickup when participants arrive, or having a separate line for carpool renewals.
- Reducing the number of required trips to the Decal office to once per year.
- Allowing UF employed spouses to pick up decals and one-day passes.

Some of these recommendations may be able to be implemented in conjunction with methods applied at other universities, such as payroll monitoring. Other recommendations provided by respondents included screening participants closer to minimize abuse, allowing carpool vehicles to park elsewhere on campus, providing 4 passes per semester to all employees that do not purchase parking decals, and encouraging park and ride facilities to be built where carpool members can meet. All of these recommendations appear to have merit, while the last recommendation is currently prioritized within Gainesville Urbanized Area MTPO Year 2020 Long Range Transportation, Needs and Cost Feasibility Plans.

In summary, participants are not in favor of the various potential changes that could improve the efficiency of the carpool program, and may even leave the program depending upon the extent to which certain changes were implemented. Participants were mostly against eliminating preferential parking locations (chosen by participants), and imposing discounts on the price of all carpool permits especially participants within three-person carpools. While predominately negative, participants appear to be somewhat less negative about the proposition for daily carpooling, active matching of members, and monitoring to ensure a minimum number of people carpool each day. Popular recommendations for improving the carpool program given by participants include increased monitoring to prevent illegal parking in reserved carpool spaces, various options to minimize the number of trips that participants have to make to the Decal Office, offering options for two-person carpools originating from Alachua County, and encouraging more participation in the program (i.e. through advertising).

Chapter 5 Summary and Discussion

This chapter provides a summary of all of the results indicated within Chapter 4, and indicates how successful the UF carpool program has been based on the calculated and observed results. It then discusses specific policies that may be affecting the performance of the program, changes that could be implemented at UF based on survey responses, policies implemented at other universities, and discussed within previous literature, and associated potential difficulties with such proposed changes. Qualitative judgments are provided based on both quantitative and qualitative results analyzed from the research.

PERSPECTIVE OF THE UNIVERSITY

Table 5.1 summarizes the quantitative results of analysis based on the impact the carpool program has at UF. Average carpool space occupancy rate, vehicle ridership, and daily participation characterize performance measures directly related to carpooling. The elimination of vehicles brought to campus, traffic on campus, and reduction in parking demand and revenues start looking at the effects of the program more globally, although reserved space occupancy can have significant implications on a more global level especially if spaces are not frequently used. Analyzing average space occupancy and average vehicle ridership, it appears that spaces are pretty well used and that carpool vehicles actually do have around two people per vehicle. Reserved space usage is typically over 77% during any given time of the day (although typically greater during morning hours), and when corrected for vehicles that are temporarily in use, carpool space utilization is estimated at over 87% for the entire day. During any given time of day, Shands Hospital has a significantly higher percentage of space utilization than main campus, but there is no statistical difference between the two locations when analyzing utilization for the entire day. Average vehicle ridership (AVR) is slightly higher for main campus than Shands, as well as being slightly more efficient. More people are typically dropped off per day for Shands carpools than for main campus. When space occupancy rate and AVR are analyzed together in terms of how many people participate each day, the efficiency drops below two-thirds. Again main campus is slightly more efficient than Shands for daily participation.

Overall however, daily participation (or otherwise use of carpool spaces by participants) is less than desired.

Analyzing the global impacts on parking and transportation at the University, only about 117 vehicles per day are estimated as being eliminated as a result of the carpool program. This represents an approximate 30% reduction in vehicles brought to campus among the participants of the carpool program (approximately 40% when excluding previous carpoolers from consideration), and only amounts about 30,420 vehicles eliminated from campus per year using 260 work-days for a typical work-year. This number of vehicles is probably the number of vehicles brought to campus each day, thus the program eliminates about one day's worth of commuting vehicles. More vehicles probably were not eliminated due to a large percentage of participants previously carpooling or using other forms of alternative transportation, and a certain percentage of current carpool vehicles either driving alone or arriving on campus below the minimum standard. The relatively low efficiency in eliminating vehicles is also given credibility from the calculations that approximately 200 people do not participate each day, 27% of the population are in carpools that have an unreasonable commute path, and 41.6% live within five miles or less of the their parking location at the University including 22.9% of the living within one mile of the contiguous university boundary.

The program has had a little more success in reducing the total number of parking decals than would have been purchased by participants had there been no carpool program – 522 gross and 289 net; however, the associated decrease in overall parking demand only drops by 1.3%, and only 2.1% for restricted employee parking. The elimination of vehicles and reduction in parking demand is achieved at a loss in revenue of approximately $99,000 per year, or 3.2% of all revenues generated from Transportation and Parking Services in 1999. This figure does not account for the expense of administering the program or the addition in revenues from towing and assessing fines for vehicles without carpool decals illegally parking in reserved carpool spaces; however, these expenses and revenues probably offset somewhat and may even be favorable towards additional revenues due to limited administration of the program by UF. Additionally with the sales of almost 30,000 decals at any given time, the impact of this lost revenue is probably minimal to the University.

Table 5.1 – Quantitative Effects of the Carpool Program at the University of Florida

Evaluation Criteria	Results	Comments
Average Occupancy Rates		Carpool Space Utilization
Time of Day (Fall)	77.4%	Significantly higher than Summer to 95% level
Day of Week (Fall)	81.9%	Significantly higher than Summer to 95% level
Time of Day (Summer)	73.8%	
Day of Week (Summer)	76.3%	
Main Campus - Time of Day	74.7%	**FALL 2000 SEMESTER ONLY**
Shands Hospital – Time of Day	81.4%	Significantly higher than Main Campus to 95% level
Main Campus – Day of Week	80.2%	No significant difference with Shands Hospital
Shands Hosp. – Day of Week	84.3%	No significant difference with Main Campus
Day of Week (Corrected)	87.3%	Accounts for vehicles temporarily in use / out of space
Average Vehicle Ridership		**Number of people per vehicle per day**
Overall	2.02	75.7% efficient (maximum total is 2.67)
Main Campus	2.09	76.6% efficient (maximum total is 2.73)
Shands Hospital	1.92	73.8% efficient (maximum total is 2.60)
Average Daily Participation		Number of people per reserved carpool space per day
Total Number of Participants	411 per day	1.76 / 65.9% efficient (621 max per day)
Main Campus	255 per day	1.82 / 66.7% efficient (382 max per day)
Shands Hospital	141 per day	1.68 / 64.6% efficient (218 max per day)
Number of Carpool Vehicles	203 per day	87.3% efficient
Elimination of Vehicles		
Vehicles Eliminated	117 per day	
Efficiency	30%	Includes all participants
	40%	Excludes current members that previously carpooled
	75%	Excludes all current members that did not drive alone
Loss in Revenue	$99,000	About $425 lost per carpool space, or $159 lost per participant
Reduction in Parking Demand		
Hypothetical Reduction in Parking Decals	289	522 decals would have been purchased w/o program 233 decals currently issued / purchased by participants
Reduction in Oversell Ratio Overall	0.02	1.3% reduction (1.54 to 1.52)
Reduction in Oversell Ratio Employee Only	0.03	2.1% reduction (1.44 to 1.41)
Actual Decrease in Overall Oversell Ratio (1996 – 2000)	0.05	3.2% reduction (1.57 to 1.52) (+651 decals sold and +1,027 available parking spaces)
Actual Increase in Employee Oversell Ratio (1996 – 2000)	0.08	6% increase (1.33 to 1.41) (+748 permits and +95 available parking spaces)
Decrease in on-campus traffic	2,282 ADT	5.9% reduction (38,716 ADT to 36,434 ADT) from 1996 to 1999 – North-South Dr., Hull-Mowry Rd, & Museum-Radio Rd. corridors
Increase in students (1997 – 2000)	4,092	10% increase (41,040 to 45,132)
Increase in UF employees (Apr 1997 to Apr 2000)	141	1.2% increase, full time only (11,670 to 11,811)

Regarding change in actual parking demand and traffic on campus during the existence of the carpool program, the University has had an overall decrease in the oversell ratio of 3.2%

between 1996 and 2000 from 1.57 to 1.52, while enjoying an approximate 6% decrease in average daily trips (ADT) on its three major roadway corridors. However, closer analysis shows the existence of the carpool program to have very little to do with this. While the overall parking demand on campus has decreased, the demand for employee parking has increased by 6% (increase in the oversell ratio from 1.33 to 1.41) even though the employee population has remained relatively constant. Additionally, the demand for commuter parking has increased by 7.6% from 2.78 to 2.99. Although students mostly use commuter parking, a certain percentage of employees also use this type of parking either as overflow parking or daily parking (especially temporary employees). The overall reduction in standard, non-employee parking demand from 1.75 to 1.60, even with the increased commuter parking demand, is most likely occurring as a result of increased use of transit service by students due to no-cost fares. The increased transit use has also probably had more of an effect on the decreasing ADT on the three roadway corridors than the 117 vehicles eliminated as a result of the carpool program. Overall, the carpool program has done little to stop the increasing demand for parking within the campus core and immediately surrounding commuter parking areas.

PERSPECTIVE OF THE SURROUNDING COMMUNITY

Table 5.2 summarizes the quantitative results of analysis based on the impact the carpool program has on the surrounding communities of UF. The results have indicated that 62 total trips and 800 miles of travel are eliminated per day for morning commute trips. These reductions in traffic are relatively small in terms of efficiency based on the total number of vehicle-trips and miles traveled by the population if they did not participate in the carpool program – approximately 10% to 14%, and approximately 14% to 19% if previous carpooling is excluded from calculations. In comparison to vehicles eliminated on campus, these reductions are less efficient. In comparison to overall traffic generated and attracted by UF and Shands Hospital (at UF), the savings are also negligible. Additionally, the savings in vehicle-trips that within the local communities directly surrounding UF have been completely swallowed up by the increase in traffic identified for major arterials and collector roads around the University. The carpool program probably has very little if anything to do with this increased traffic

surrounding UF; however, the traffic increase is probably impacted significantly by the increase in over 5,700 full-time students since 1996.

Most of the elimination in total vehicle-trips is attributed to Alachua County residents because a large majority of carpoolers originate within the County. However, participants residing outside of Alachua County actually eliminate more trips per person per day by a slight margin. Also, participants residing outside of Alachua County eliminate more vehicle-miles of travel, but in this case by a very large margin both in absolute terms (by almost 10 times) and in relative terms (by almost 20 times based on miles eliminated per person, and by over 3 times based on percentage of miles saved vs. average home-to-work trip distance). Participants living outside of Alachua County probably have a greater impact in eliminating vehicle-trips and miles of travel because County residents previously used alternative transportation modes other than the automobile, especially the participants living close to the university, while non-County residents primarily either drove alone or carpooled. Additionally, non-County residents especially two-person carpools (94%) were overwhelmingly part of carpools that have reasonable commute paths, while 90% of the unreasonable commute paths originate within Alachua County.

Table 5.2 – Quantitative effects of carpool program on the surrounding communities of UF

Evaluation Criteria	Results	Comments
Elimination of Vehicle-Trips		Vehicle-trips are eliminated from the morning commute
Overall trips	62 per day	
Efficiency	14.1%	Includes all participants (62 out of 440)
	19.4%	Excludes previous carpoolers (62 out of 320)
Inside Alachua County*	33 per day	0.08 per person per day (9.7 out of 121 survey respondents)
Outside Alachua County*	19 per day	0.09 per person per day (6 out of 67 survey respondents)
Elimination of Vehicle-Miles Traveled		Eliminated from morning commute
Overall Miles of Travel	800 per day	1.3 miles eliminated per person 1.86 miles eliminated per person not including previous carpoolers
Efficiency (Including carpoolers)	9.5%	1.3 miles eliminated / 13.7 average total trip distance per person
Efficiency (Excluding carpoolers)	13.8%	1.86 miles eliminated / 13.7 average total trip distance per person
Inside Alachua County*	65.5 miles per day	Roughly 0.16 miles per person per day (416 residents)
Outside Alachua County*	617 miles per day	Roughly 3 miles per person per day (205 residents)
Increase in traffic within local community (1996 to 1999)	18,600 ADT	Major arterials and local roads around UF 6,200 ADT per year

* Does not include vehicle-trips and miles of travel saved due current members being dropped off prior to joining the carpool program.

PERSPECTIVE OF THE PARTICIPANTS OF THE PROGRAM

Based upon the results indicated in Table B.4 in Appendix 4, it is clear that most of the participants feel that the program is convenient, and enjoy a variety of incentives that makes up for the typical disadvantages and loss of freedom from no longer driving alone. The most popular incentives by far include the reserved, priority parking spaces, and free or discounted parking permits. The four passes to park individually per semester and the emergency ride home benefits were also predominately important, but not as much as the reserved parking space, and free or discounted price. The fact that most participants view previously knowing other members as highly important to their joining the carpool program may cause difficulties for active matching of members; however, about half of the participants at least are not opposed to the idea of matching. The fact that a high percentage of participants indicated they participate because they believe it is beneficial to the community, yet at the same time appear to be relatively inflexible with proposed changes that could potentially improve the efficiency of the carpool program may indicate that many of the participants are not sincere in there overly positive responses to this question. Additionally, all of the traditional reasons for carpooling, including savings of gas and vehicle maintenance, and opportunities to socialize, relax, or work were ranked at or towards the bottom of the chart, thus the program incentives are probably among the top reasons people joined and remain with the program – approximately two-thirds of the participants have been participating for at least two years. Another major benefit that participants enjoy is that they do not have to get to work as early as the remainder of employees who purchase general parking decals since their spaces is always reserved.

While everyone in the program tends to benefit somewhat, there are those that benefit more than others. The participants that are able to drive under the minimum standard, or only carpool once in a while when it is convenient probably receive the highest benefit because they are not typically faced with the inherent disadvantages of carpooling yet they still get their free, preferential, reserved parking space ordinarily valued at over $500. The results of the analysis have shown that this "abuse" almost certainly occurs, and it will be discussed in further detail within the next section of this chapter. Those that tend to benefit less, or be at a bit of a disadvantage are the participants that live towards the outskirts Alachua County, especially at

distances greater than non-County residences where population densities are a lot less. These people are still required to meet the three-person minimum standard for carpools originating within Alachua County, yet they have geographic characteristics more like non-County residents that only have to meet a two-person minimum standard.

While the program tends to be primarily beneficial for participants, there are some other disadvantages and dislikes that participants face. They are required to travel to the Decal Office three times per year as a means of ensuring they are still employed at UF and still participate. This was the top complaint of participants, although it was still relatively minor in quantity. Participants also cannot park anywhere on campus but their reserved space, which also means they are stuck if someone illegally parks in their space until a tow truck can remove the vehicle. Illegally parked vehicles was the second highest dislike, but when combined with the dislikes of waiting for a tow truck and not being able to park elsewhere on campus (third and fourth highest dislike) the problem starts becoming a bit more of an issue with participants. However, even with these disadvantages and miscellaneous other dislikes, the benefits of the program to participants appear to far outweigh the disadvantages.

ABUSE

While no evaluation measure within this research project was performed to determine specifically where and how much abuse was occurring, and who specifically was abusing the program, the results of the research do tend to strongly indicate that some abuse is occurring. The maximum abuse of the program on is probably around one-third, or 33.3% assuming two-thirds of the population participates on a given day (see results for ADP in table 5.1). In reality however, this percentage is probably lower because each participant is eligible to drive alone four days per semester (roughly 5% of time), while on other days a participant may be sick or on vacation. Abuse may thus actually be closer to 25%.

Some of the specific results that tend to indicate that abuse is occurring include the following items. First, some of the survey respondents specifically indicated that they do not typically, or sometimes ever carpool with their assigned group. Less exact but in much higher quantity, over 200 members on average per day were determined to not carpool, or use the carpool space. This

can mean a person uses an alternative transportation method other than carpooling, is parking elsewhere on or off campus, or is not showing up for work during an average day. In fact, over 20% of transportation modes for current members before joining the carpooling program was other than automobile or carpool. Many of these employees are still probably using the same alternative transportation methods (bus, bike, and walk) based on the number of employees that do not participate each day, and based on the close proximity of many of these people to UF and their place of work as discussed next.

A substantial percentage of the population lives very close to the University as already indicated various times – over 41% live within 5 miles of their assigned parking space on campus, while approximately 23% live within 1 mile of the UF contiguous boundary. For many of these people, the physical act of carpooling does not seem to make sense in terms of effort to actually carpool. In other words, it would take a lot less time to either walk, bike, or take the bus (although for people that live very close to their work location on campus, taking the bus may also not make sense especially if the wait time is longer than the walk time). The arrangement of various home locations also makes a certain amount of carpooling also seem impractical, especially when members of the same carpool group live in three separate quadrants surrounding the University, or just very far apart in relation to the distance to the University from their homes. A final area of abuse may occur where participants do not start work around the same time of day.

Many of these employees do carpool at least some of the time; however, taking all of this information in conjunction with one another, it becomes pretty clear that a certain percentage of the population does abuse the system. Although no specific groups were really pinpointed for evaluation for abuse, during the research process two groups seemed to stick out as being high risk for abuse – Post Doctoral Associates (PDAs) and employees that work at University Press. While there is no concrete proof, these groups both had extremely high percentages of members as part of carpools with unreasonable commute paths and living within much closer distances to their parking location on campus than the rest of the carpool population. A good percentage of PDAs live within the one-mile boundary of UF as well. Another potentially incriminating fact is that both PDAs and employees of University Press responded to the survey in percentages well

under the overall average for survey response. There may be a bit of a language barrier because almost 90% of PDAs are Asian or Pacific Islander, they still appear very suspect in combination with the other factors just mentioned. However, employees of University Press have no such language barrier.

IMPACT OF UNIVERSITY ADMINISTRATION AND POLICIES

Table 5.3 summarizes the quantitative results of the impact that administration has on the effectiveness of the carpool program. The apparent lack of initial screening and monitoring of participants when they apply to join the carpool program by Transportation and Parking Services probably contributes significantly to the abuse that is occurring, or at least to the relatively high percentage of employees that do not participate or carpool each day. While preventing potential carpoolers from joining the carpool program based on previous mode of transportation is probably not fair or reasonable, disallowing participation because potential groups do not have a reasonable commute path or do not work in compatible work schedules, especially since these are identified within the program requirements, is fair and reasonable. However, the fact that the University is not specific in what they mean when they indicate that employees must start work "at about the same time of day" or commute in "a reasonable commute path" could leave the University open to challenges by participants if their permits are initially disallowed or revoked.

Free parking probably contributes significantly to abuse in combination with other abuse factors because employees are not impacted when they do not participate. If they actually had to pay a fee, they would probably think twice before submitting their name with a carpool group and then never or very infrequently carpool. Additionally, no longer issuing free carpool permits would also probably reduce the amount of revenue lost to the University, both from the permits themselves and from people that do not legitimately carpool that would leave the program and buy a regular decal. However, increasing fines for illegal parking in carpool spaces and associated towing fees would also increase revenue, while also providing greater deterrence from illegal parking.

The requirement for Alachua County residents to form three-person carpools probably places residents that live towards the outskirts of the County where population density is low at a

disadvantage in comparison to residents that live closer to the University and non-County residents that are allowed to form two-person carpools. This is because residents living closer to UF have a greater source of employees to match with, and because County residents living far away from the University share the same characteristics as non-County residents and often times live farther away from the University than non-County residents. However, the requirement for two-person carpools to pay a discounted fee rather than being issued a free decal is not inherently unfair because three-person carpools (when used as intended) derive more benefit than two-person carpools.

Table 5.3 – Quantitative impact of UF administration of the carpool program

Evaluation Criteria	Results	Comments
Work Schedule Compatibility	87% compatible	Less than 1 hour difference in work start times (199 out of 228 carpools) Of remaining 13%, one-third of carpools originate from same household.
Reasonable Commute Path		
Unreasonable Commute Path	24% (carpools) 26% (participants)	All members live outside a ninety-degree arc of their designated parking location.
Loosely Reasonable Commute Path	16.3% (carpools) 18% (participants)	While within a ninety degree arc members are still not grouped very well based on the geographic dispersion of their home locations versus the availability of numerous other carpool participants located close to their homes, many within the same housing subdivisions or apartment complexes, or along a relatively linear paths to the university.
Mostly Reasonable Commute Path	59.2% (carpools) 55.1% (participants)	Best meet intent of reasonable commute path.
One or two people in the arrangement live adjacent to the University boundary, and the other member or members live far away from the university.	29 carpools (12.4%)	About 1/3 are located in each unreasonable, loosely reasonable, and mostly reasonable categories.
Minimum Person Requirement		
Overlap of Alachua County residents living further from UF than non-County residents.	Approx. 40 participants	Required to form 3-person carpools, while non-county residents living closer to UF can form 2-person carpools.
Unreasonable carpools becoming reasonable with 2-person minimum.	87.5%	Percentage of currently 'unreasonable' carpools that would be reasonable if 2-person minimum standard was adopted. (49 of 56 carpools)
Awareness of program		Percentage of current participants that became aware of program through these methods.
University publication / document	23.3%	Approximately 88% of these participants have been members of the program for at least 2 years.
Trans & Parking Services	13.2%	May contribute to stagnation of additional carpools in the program over the last 2 years. See Table 4.8.

The lack of recent advertising, marketing, and making the carpool program more visible to the general population may be keeping participation at a relatively static rate over the last 20 to 24 months. The apparent lack of a good record keeping system probably does not impact on the performance of the carpool program per se, but it does make tracking progress over time very difficult and it is somewhat symbolic of how the University views the carpool program.

The Campus Master Plan (CMP) does not appear to have major impact on the carpool program other than the policy that specifically indicates that the University shall reactivate the carpool program with incentives such as preferential parking locations and reduced parking decal fees. The CMP has called for parking pricing strategies to make other modes more attractive; however, the 5% per year increases in all parking decals since 1995 has not really deterred employees from continuing to purchase parking decals, nor significantly helped increase the number of carpools over the past two years. This is probably mostly attributable to parking at UF still being priced inexpensively relative to other universities with successful carpool programs, as well as other universities in general (Flynn, 1996). Other policies and actions that may also not work that well or negatively impact parking and traffic within and around UF include: the increases in peripheral parking because more interior decals continue to be purchased each year, lifting parking restrictions on campus at the same time that many employees leave work, and the increasing student enrollment beyond original projections which may be increasing traffic on roadways surrounding the University (possibly from non-peak or non-campus related trips). The lack of enforcement on parking restrictions in nearby neighborhoods such as College Park and University Heights may also be failing to deter a significant number of people from parking their vehicles within close proximity to campus. Policies from the CMP that have appeared to meet with better success is the use of transportation fees and funds to cover the full cost of transit service, and possibly the limiting of freshmen and sophomores from parking on campus.

POTENTIAL FOR CHANGES TO THE UF CARPOOL PROGRAM

The first way that UF could improve efficiency is to optimize carpools that have members with compatible work schedules and reasonable commute paths. This would involve screening

employees during the application process to ensure they meet a specific definition for compatible work schedule and reasonable commute path that would be clearly defined with the program regulations. For employees that do not know other potential compatible carpoolers, the University could assist with matching employees from a centralized database of both current and prospective carpoolers. Prospective carpoolers could be obtained by taking applications from interested persons or proactively seeking people that may be interested in carpooling, i.e. when people purchase regular parking decals at the Decal Office, through campus transportation brochures, the Transportation and Parking Services website and inquiries within individual campus departments. UF may want to convince the City of Gainesville to assist with matching University employees (including with other City employees that work close to UF) because of the substantial benefit to the community that would occur as a result of successful matching of compatible employees. UF may even want to consider regrouping the carpools that currently are not temporally or geographically compatible since it appears that a significant percentage of carpools can be made much more efficient based on the proximity of home locations of carpoolers from differing groups. The University would most likely get a lot of resistance from this, but if it eliminated a large majority of illegitimate participants at the expense of only a small minority of legitimate users then it would probably be worth it.

UF would probably improve efficiency by charging a fee for all carpool decals. As indicated within the Abuse section, having all participants pay a fee to participate in the program acts as a deterrent against those who would submit their name and not carpool, and reduces the amount of lost revenues from fewer regular decals being sold. The revenues collected from carpool permits could also potentially be used to help pay for a dedicated alternative transportation coordinator. Charging all participants to join the program is consistent with the CMP which never specifically indicates that carpool permits should be free, only reduced price, and is consistent with the fact that all of the other Universities charge their carpool program participants. The current participants of the program will have a problem if the University starts charging fees, especially those that currently do not pay (three-person carpools). However, there are possible ways in which initiating and implementing a payment program that may sit well with existing participants, and yet also attract new participation.

UF could eliminate the three-person minimum requirement but keep charging a price for two-person carpools based on the theory that two-person carpools provide less benefit than three person carpools. A tiered-system of fees could also be used similar to UCD and Cornell, where fees are higher for two-person carpools and at parking locations that are in greater demand, while fees are lower for three-person carpools and locations that are in less demand. UF may just want to go to a simple system where the participants share the cost of the decal based on the type of decal and location of parking, where a larger number of participants means less cost per person. The additional advantage of eliminating the three-person minimum requirement is that people living towards the outer edge of Alachua County would no longer have the disadvantage of having to find an additional participant than their non-County brethren.

UF would probably improve overall participation in the program by administering an active information, awareness, advertising, and marketing program that would aggressively attempt to convert more employees to carpooling (and other forms of alternative transportation). With around 20,500 employees commuting to UF each day (including OPS and Shands Hospital employees), only about 3% of employees are currently in the carpool program. This means that UF has an additional employee base of nearly 20,000 that could possibly carpool, or use other types of alternative transportation at least some of the time (many of which currently do). Because many of the current carpool participants were not aware of the carpool program before joining, chances are that a large majority of the remaining employees are not currently aware of the carpool program and the benefits that it offers. Many are also probably not aware of the harmful effects that solo driving has on society. A proper awareness and marketing program, would probably not only get employees more active with alternative transportation, but would also hopefully maximize the appropriate transportation mode based on employee home locations – i.e. those living within 1 mile of the UF boundary should use transit or bicycle instead of carpooling.

Potential changes in the program that will probably offer the greatest resistance from current participants is changing around the current system of reserved parking spaces. From the results of analysis of this project, parking locations appeared to have little to do with the performance of the carpool program, other than reserved parking spaces at Shands Hospital having statistically

higher auto occupancy than main campus, and main campus having slightly higher personal participation per space. Perhaps the highly beneficial locations of reserved spaces may have induced some employees to join even they do not use them that often, but it is unclear how changing locations will affect the performance of the program, i.e. in terms of eliminating vehicles brought to campus or overall vehicle-trips.

However, consolidating reserved carpool parking into generalized locations could possibly benefit the University by freeing up spaces for general use since the average carpool occupancy rate at any time during the day was 77.4%. A consolidated and generalized system of parking would be less disjointed and spread all over campus, thus probably enabling easier monitoring of spaces and allowing for access control that could potentially reduce the amount of non-permitted vehicles parking in reserved carpool spaces. Most of the universities researched for this project had generalized systems of parking, some having access control into garages. If UF went to a generalized system, it might also want to move locations outside of the campus core and off the streets consistent with pedestrian and non-vehicular circulation sub-element of the CMP.

The Criser and Chemistry Lab parking facilities appear to be good locations for access control, are adjacent to the campus boundary, and yet are still in high demand areas. The Newell parking garage, the parking areas on the intersection of Museum Road and Center Drive, and along North-South Drive by the O'Connell Center and across from the Physics Building are also good locations just outside of the campus core. Garage 3 appears to be a good location for Shands parking, while the 1329 Building could remain usable for carpoolers because it is isolated from the rest of campus. Participants could still be given a choice which lots they would like to primarily use based on availability. In order to ensure that everyone does not choose the most premium locations, carpool permit prices could be tiered based upon the demand for those locations. In order to allow for additional future participation, carpool parking areas should be sufficient size to allow for expansion.

Generalized parking could also be considered for those people that like to carpool occasionally, i.e. two times per week or less. The University might want to first get an idea of how many employees would be willing to carpool occasionally in order to most accurately allocate a

location. If the University stays with the current system of parking, they might consider opening up the reserved parking for general use in the afternoon for the carpools that work from 5:00 AM to 1:30 PM, and allowing general use in the morning for the Shands carpools that start work in the afternoon. The latter however may cause problems with regular employees moving their vehicles by the required time in the middle of the day.

Another suggestion that the University might choose to address is regarding the monitoring of the payroll deduction of participants in the carpool program. Half of the universities researched indicated they monitored payroll deduction (Cornell every pay period and Penn State every month) to determine whether participants were still employed at their university. This may alleviate the need to have participants visit the Decal Office every semester, and possibly allow decals and one-day passes to be mailed or reordered through the internet. Also, perhaps Transportation and Parking Services staff could set up a temporary satellite location within main campus (i.e. HUB or Reitz Union) and Shands Hospital so participants would not have to travel so far to renew their membership.

The amount of program administration and management that are discussed with these above potential changes would be significant, and the University would need to hire additional staff to perform these tasks. A rideshare coordinator might be considered, or an alternative transportation coordinator that would also manage transit and non-vehicular programs. As indicated within Chapter 2, drive alone rates were found to be consistently lower (by at least 10%) for employers over 100 employees that offered personalized matching assistance versus employers that did not offer this service (Ferguson, 1990b). Similar to Cornell, a dedicated transportation planner might be considered that can split time with the Campus Planning Department and Transportation and Parking Services Department. With additional administration comes additional cost. Assuming the cost of a manager and an assistant costs $90,000 per year to the University, based on an average of approximately 30,000 decals sold each year a $3.00 increase per decal would cover the necessary additional cost.

While all of the potential changes mentioned above will probably serve to increase the efficiency of the carpool program and quite possibly increase the amount of people that participate, UF should also consider further methods to make solo commuting less desirable than carpooling and

other forms of alternative transportation. The savings that could possibly result to the University if it no longer had to build one or two of the parking garages indicated in its CMP Capital Improvements Element could be $5 million to $10 million or more; however, a more comprehensive TDM approach would be necessary than just the carpool program to reduce the traffic demand by enough to no longer have to construct the additional facilities. The University may therefore consider hiring a coordinator or transportation planner with TDM experience. Additional TDM methods are discussed next.

Similar to Cornell, and in accordance with the CMP and 1996 Recommendations of the Presidential Task Force on Transportation and Parking, UF should consider raising prices substantially above where they are now except perhaps remote parking (i.e. Harn Museum and west of SW 34th Street) where supply is currently greater than demand. Because demand is so high with interior main campus and premium Shands parking areas, these areas should cost the most. As one travels further away from these areas, prices could decrease due to less demand. Because commuter lots are also in very high demand, they should also be priced accordingly. The Presidential Task Force provided recommendations for parking at $250 per year for premium employee parking which basically covers all current general parking other than gated and student parking within the main campus quadrant. After four years at five percent per year, this value is now worth just over $300 per year. This value, while still pretty well below parking prices at the other universities researched, may still be sufficient to meet the demand for employee parking while inducing many current employees that drive alone to switch to an alternative mode. However, the University may want to review the pricing recommended by the Presidential Task Force (i.e. through the Committee on Transportation and Parking) to ensure that prices are set well enough to induce changes in mode choice, and possibly even cover costs of other transportation projects and programs, including subsidizing alternative transportation projects and programs.

Another recommendation of the Presidential Task Force was to implement enhanced transportation zones of improved transit and non-automobilie accessibility, where students living in these areas would no longer be eligible to purchase a parking decal. UF may want to reconsider implementing all or part of this plan because it would serve to significantly reduce the

demand on parking from students that live very close to the University. It might also reduce some of the demand in commuter areas just outside of main campus and Shands Hospital to where employees could park in these areas much more easily than they do now. If done in conjunction with increasing employee parking as indicated in their recommendations, the overall result may provide significant net reductions in parking demand at UF.

However, while this report is NOT endorsing decreasing employee parking any further than has already been done (other than perhaps on-street parking in support of the CMP pedestrian and non-vehicular sub element, with comparable replacement using commuter areas just outside of the campus core), an increase in 1,800 employee spaces from the current amount would probably result in a significant percentage of current carpoolers, and other employees currently using alternative forms of transportation, defecting back to solo driving due to triple convergence. UF should consider Cornell's position in reply to an inquiry to convert student parking spaces to employee spaces and bar students from bringing cars to campus: "The growth in parking demand is due to staff who desire more convenient space, rather than by resident students who park in more remote areas." This appears very similar to the situation at UF based on increasing demand in core campus areas over the last four years. However, because commuter parking demand has increased substantially in last four years, remote parking areas generally go underused, and students flock to main campus with their automobiles as soon as parking restrictions are lifted at 4:30 PM, students are most likely also contributing significantly to the increased parking demand in campus core and immediately adjacent areas. If UF ultimately decides to increase employee spaces by 1,800 spaces or similar, then a significant increase in parking prices would probably be the only way to prevent an exodus back to solo commuting. The University would also have to find additional ways to restrict students from bringing cars to campus; otherwise, the demand in commuter areas will continue to skyrocket.

Another alternative that UF could consider that is popular with the other universities is to determine and sell an acceptable finite number of parking decals. Along with this could be the implementation of lot assignments and wait lists. The total number of permits sold would ensure that UF, while having a certain percentage of oversell, would not have the problem that is occurring now. This may actually be the best method to reduce vehicles on campus because it

provides a cap on the number of vehicles that can physically travel to campus, but only during restricted hours. The University should consider moving restriction time periods back to 6:30 PM as recommended by the Presidential Task Force. This would probably mitigate the traffic problem that currently exists during the afternoon after 4:30 PM when restrictions are currently lifted and employees are heading home for the day, plus it further restricts the amount of vehicles that students can bring to campus when transit and other forms of transportation are still viable options. Additional enforcement by UPD would probably be required for the additional two hours of restriction, but could also be funded through higher parking fees.

UF could also consider additional paid daily or short term parking priced accordingly in campus core areas (similar to the Reitz Union) to enable employees, students, and visitors to park relatively close to their destination on campus on days they only need to make stops of short duration, or absolutely need to park close to their destination. This may also reduce the incidence of visitors and students parking in employee assigned areas within the campus core, thus freeing up some additional premium parking spaces for employees. Additionally, any changes that makes solo driving to campus more restrictive should be accompanied by strong enforcement by the City of Gainesville to ensure that a significant number of people attempting to avoid the parking restrictions do not illegally park in neighborhoods immediately surrounding UF. Recommendations about how many of these potential changes should be implemented at UF are provided in the next chapter.

Chapter 6 – Findings, Conclusions, and Recommendations

This chapter identifies the specific findings of how effective the University of Florida carpool program has been from the perspective of the University, its surrounding communities, and the participants of the program, the impact that University policies and administration have on the effectiveness of the program, provides a general conclusions, and then provides a recommended list of changes that UF can implement to improve the effectiveness of the carpool program. Recommendations for future research are provided last.

Findings

1. From the perspective of the University, the carpool program has been marginally to moderately successful at eliminating vehicles brought to campus only considering the current participants of the carpool program based on previous modes of transportation before joining the carpool program. However, the level of impact on the overall parking and traffic situation at UF is extremely small. Specifically:

- An approximate average of 117 vehicles are eliminated from campus each day, an approximate 30% decrease in vehicles brought to campus based on the number of vehicles previously taken to campus by the carpool population. The resulting of elimination in vehicles for a work year is approximately 30,000 vehicles, or one day's worth of commuting to UF.
- An approximate average of 411 members participate (carpool, or otherwise use reserved spaces) each day, which is 66% of the total carpooling population at UF.
- An approximate average of 210 members do not participate in the program each day, and includes members that use alternative transportation modes other than the carpool, solo drivers that park elsewhere on campus or off campus, or do not travel to campus.
- A total of 289 net decals are avoided from being sold to employees by the University, resulting in a hypothetical reduction in parking demand by 1.3%, and a reduction in demand for employee designated parking by 2.1%.

- Carpool spaces are occupied on average 77.4% over the course of the day, where the spaces have significantly higher usage during the morning hours.
- Spaces are occupied more frequently during the mid-week days – most on Wednesdays, and least on Mondays and Fridays.
- Shands Hospital parking spaces have a significantly higher [vehicle] occupancy rate than main campus parking spaces, but main campus has a higher participation rate per space.
- The ability for students and employees to use the Regional Transit System at no cost probably does significantly more to reduce parking demand and traffic on campus than the carpool program.

2. From the perspective of the surrounding communities, the carpool program has also been marginally to moderately successful at eliminating vehicle-trips and miles of travel made by participants of the program, although somewhat less efficient than from the perspective of the University. The impact on the overall traffic in the community is also almost negligible. Specifically:

- An approximate average of 62 vehicle-trips during the morning commute are eliminated per day by participants of the carpool program, a 14.1% decrease in trips made by the entire carpooling population from before they jointed the program. Not including the segment of the population that previously carpooled, the decrease increases to 19.4%.
- Participants eliminate approximately 800 vehicle-miles of travel each day during the morning commute. This represents an elimination of 1.3 miles of travel per participant of the carpool program, or 9.5% of the average travel distance an employee would have to commute if he or she did not carpool. Excluding people that previously carpooled, the elimination is 1.86 miles of travel per participant or 13.8% of the average travel distance that he or she would have to otherwise commute.
- The total number of vehicle-miles eliminated during the morning commute per work year is approximately 208,000 miles. This number is still extremely small in

comparison to the total number of vehicle-miles traveled by UF commuters, probably also not more than one-day's one-way commute.

- Approximately 90% of all vehicle-miles of travel saved are attributed to participants residing outside of Alachua County, while carpools that have a reasonable commute path contribute approximately all, if not more than all of the savings in miles of travel.

3. The effectiveness of the program from the perspective of the University and the surrounding community, especially regarding the elimination of vehicles brought to campus, vehicle-trips and miles of travel, is significantly limited because only approximately one-half of the participants in the carpool program drove alone before joining the program.

4. From the perspective of the participants of the program, the carpool program is very convenient and members for the most part very much enjoy the benefits offered by the program, although this success comes at the expense of the University and the surrounding community. Table B.4 in Appendix 4 summarizes those priorities in ranked order: reserved, preferential parking, free and discounted prices, previously knowing members, and four one-day passes to commute individually are the greatest reasons for people joining and remaining with the program. Inherent reasons to carpool, such as savings in gasoline and vehicle maintenance and social benefits are less important. Some of the disadvantages include traveling to the Decal Office at the beginning of each semester to verify their continued participation, not being able to park carpool vehicles elsewhere on campus other than their reserved space, and residents of Alachua County living close to the border having to form three-person carpools. Overall however, the benefits and advantages of the carpool program appear to far outweigh the disadvantages.

5. A certain level of abuse is occurring within the carpool program – a maximum of 33% but probably closer to 25%, where abuse is characterized by an excessive lack of participation by members of the program. While no one factor proves that it occurs, a combination of the various results strongly indicates that it occurs including: admissions in survey responses, the number of members that do not carpool each day, the percentage of members that previously used forms of

alternative transportation other than the automobile and live within very close proximity to the University, and the percentage of carpool groups that do not have compatible work schedules or reasonable commute paths. Two segments of the campus population that are likely abusing the program are Post Doctoral Associates and employees working at University Press.

6. UF administration of the carpool program is a major contributing factor in the limited effectiveness of the carpool program. The lack of screening of applicants and enforcement of the reasonable commute path standard is enabling incompatible carpools to form, while the free permit prices enable employees that do not typically carpool to join at no cost whatsoever to themselves. The three-person carpool requirement for Alachua County residents puts the members living towards the edge of the county at a disadvantage. Additionally, the lack of an adequate information, advertising, and marketing program has probably caused a lack of increased participation by campus employees. While the Campus Master Plan (CMP) has done little to impact the performance of the carpool program, the increases in the price of parking as called for in the CMP has done very little to increase participation in the carpool program during the last two years, probably due to low cost parking fees at UF especially in high-priority, core campus areas.

Conclusion

To date, the UF carpool program has not been successful in reducing parking demand within, and eliminating vehicle-trips and miles of travel within and around UF, the primary reasons for establishing such a program. The program is clearly beneficial to the participants, a definite objective of the program, but the benefits that participants receive are not justified based on the limited savings to UF and the surrounding community. While the carpool program as currently implemented is not providing the desired results, there is more that UF can do to improve the performance of the program because so far, UF has not much to ensure the program is working either effectively or efficiently.

The success of any improvements to the carpool and other transportation programs at UF will be determined based on how the University decides to package its policies and strategies. However,

in order for the University to see the best results it will have to look at all options comprehensively. Many options for changes provided in Chapter 5 should be part of that comprehensive package to ultimately reduce solo driving to UF. Cornell's TDMP is probably one of the best programs to review in determining what could work at UF, based on Cornell's success in attracting both carpooling (13% of employee mode share) and transit, and its relative similarity to UF in metropolitan character. Other universities should also be consulted for additional strategies such as California-Davis and Wisconsin-Madison because they are also similar to UF in metropolitan character, while the University of Washington, Seattle probably has the most comprehensively packaged transportation program with their U-Pass program.

It is understood that some of the changes will take a certain amount of time to implement, and may not see positive results immediately. Almost all of the options are restrictive in nature and will be resisted by the current carpool population and the remaining campus population that is so dependent upon automobile travel, depending upon the options that are being considered. However, changes are justified at UF even if participation decreases in the short term because of the limited success of the carpool program and the increasing demand for parking. Because of the shared concerns between UF and the local community to reduce traffic congestion and its negative effects, the local community should also be more involved and share some of the responsibilities for trip reduction with UF. In order to account for the varying perspectives of the campus population and local community, UF ultimately may want to commit to a long process similar to what occurred at the Universities of Washington and Cornell in the early 1990s, that would involve the campus and local communities working together jointly to develop and implement a TDM and alternative transportation program that works for all people. However, a strong commitment by the campus population and its leaders will be needed for such a process to work.

Recommendations

When considering changes to the carpool program and other transportation policies, UF should consider the long-term success along with short-term gains that would be achieved. UF should also determine what it can implement immediately, and what will require more time for

necessary review and consideration before implementation. Generally, much of the improvements to the carpool program could be implemented relatively quickly while most of the changes to other transportation policies will require a longer time frame for proper implementation.

In the short or immediate term (i.e. to take effectiveness by the Summer or Fall 2001 term), UF should:

Clarify the requirements of the program, especially with regards to compatible work schedules, reasonable commute path, and the minimum number of days that a participant must carpool – at least 3 days per week. Clarify the emergency and guaranteed ride home provisions of the program since many people may not be well aware of it.

Initially screen all carpool applications prior to approval and deny applications that are not temporally or geographically compatible. However, provide a list of available choices of people that would be considered compatible to applicants that are denied approval. Employees living within one mile of the contiguous boundary of campus should not be eligible for participating in the carpool program.

Begin an active personalized matching program to assist employees interested in carpooling that are unable to find compatible partners on their own. This can be administered jointly with, or primarily through the City of Gainesville (similar to the regional ride matching agencies the service the other universities). Employees could fill out a "match-list" form at the Decal Office, or submit one through campus mail or the internet.

Change the three-person minimum requirement to a two-person minimum requirement. All carpool participants in a group regardless of number of people will share the cost of an orange or blue permit. Carpools in a commuter lot will share the cost of a staff commuter permit.

Hire a full-time alternative transportation coordinator that will be able to screen carpool applications based on compatibility of work schedule, home location, and possibly other items such as work location and smoking preference. The coordinator will also be in charge of advertising and marketing the carpool program, including all benefits involved with the program, and educating and informing the campus population as to the benefits of carpooling and other forms of alternative transportation, and the problems involved with solo commuting. Additional staff should be hired as necessary, ultimately funded by the increases in carpool and regular parking permits.

Consider alternate methods for participants to renew membership other than requiring them to travel to the Decal office at the beginning of each semester.

Move the time that parking restrictions are lifted back to 6:30 PM.

In the longer term, UF should also investigate and implement the following TDM strategies to ultimately reduce the amount of solo driving to the University:

Raise the price of regular decals significantly enough to get people's attention, and research pricing alternatives for both regular and carpool permits. Higher demand parking areas should ultimately cost more than lower demand areas. Carpools with two persons should cost more than carpools with three people. Continue to ensure that campus shuttle service adequately services more remote parking areas. Consider how parking fees could be used to fund transportation projects and programs on campus, and at the same time deter excess parking demand in core campus and high priority areas. Areas identified as premium within the 1996 Presidential Task Force on Transportation and Parking should ultimately cost no less than $300 per year.

Determine potential locations where reserved parking spaces for carpools can be consolidated and generalized, to include potential areas for daily carpooling and access control while ensuring enough area for future expansion. Obtain suggestions and

requests from the Campus Committee on Transportation and Parking and from current carpool participants.

Closely work with the City of Gainesville and Alachua County (i.e. Codes Enforcement , Public Works, RTS, and MTPO) to ensure they assist and complement the efforts at UF. Specific areas include ensuring that parking restrictions in neighborhoods surrounding UF are strictly enforced, assisting UF with matching employees to carpools (including with non-UF employees), providing and designating park and ride facilities, and ensuring that transit service improves its frequency, routing, and reliability in order to handle additional capacity from UF employees, especially in areas within one-mile of the UF boundary. Specify this through the Campus Development Agreement.

Review parking, carpool, alternative transportation, and TDM policies and strategies implemented at other universities nationwide. Cornell's program should be analyzed first, but also consider strategies that are implemented elsewhere such as the Universities of Wisconsin-Madison, California-Davis, and Washington, Seattle.

Research and limit the number of parking decals that are sold at UF to a more acceptable level of oversell. For areas of higher priority, implement a waitlist system similar to what currently exists for gated parking.

Implement an enhanced transportation zone system applicable to both students and employees similar to that specified in the 1996 Presidential Task Force. First consider College Park, University Heights, and the Depot / PK Yonge neighborhoods (down to SW 16th Ave). Then consider other neighborhoods within one mile of the contiguous University boundary, and ultimately all three enhanced transportation zone regions.

Identify specific, but realistic transportation reduction goals for trip reduction programs, and report the results every one to three years in order to determine where efforts have been successful and where they need to be improved.

Increase the number of one-day passes to six or eight per semester if efficiency of the carpool program improves significantly as a reward for existing participation and further incentive for additional participation.

Research the possibilities for student carpools.

Seriously consider convening another task force involving various groups of the campus and local community to develop a comprehensive TDM and alternative transportation plan that would sufficiently benefit all elements of the campus population and local community.

If all else fails, consider a simple system of carpooling similar to the University of Minnesota where a couple of separate parking facilities are assigned in priority areas (perhaps one in main campus and one at Shands Hospital) for carpooling on a day-by-day basis, where people pay a reduced fare (or receive monetary credits) in exchange for entry into the facility to park. Even if not in great quantity, employees will continue to carpool and there is always a demand for less expensive, preferentially located parking.

Recommendations for Future Research

This research project covered many different areas of the carpool program at UF, as well as many other issues related to transportation and parking because they are very interrelated. While the research got very specific in many areas, it was not able to adequately address everything related to carpooling, parking, and transportation at UF. Therefore, the following areas are recommended for further research:

- Determine whether household-based carpools are receiving an unfair advantage as compared to non-household-based carpools, especially as they relate to a two or three-person minimum carpool standard.

- Determine more specifically what constitutes abuse of the program and develop specific evaluation measures to determine whether or not it occurs, which groups are abusing the program, and the specific causes of the abuse.
- Determine more objective and scientific evaluation measures using GIS to determine whether or not carpool groups are geographically compatible. GIS programming could also be used to screen applicants, and optimally match people interested in carpooling based on a variety of factors such as home location, work schedule, work location, and other potential factors for both UF and non-UF employees.
- Determine the effect that transit and other alternative transportation programs have on the reduction of traffic and parking demand on campus and in the neighboring communities, using a greater population base for the research.
- Determine the relationship between transit and carpooling, and what specific policies and strategies would ensure that both methods of transportation are optimized and complementary.
- Evaluate specific factors that have made some university carpool, alternative transportation, and other TDM programs more successful than other university programs.

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Appendix 1

Field Monitoring Forms

LOCATION	AREA	NUMBER	Size	Time Constraint	Date/Time	Day of Week	Status	Comments
1329	B	70,025	3					
1329	B	70,051	3					
1329	B	70,076	2					
1329	B	70,082	3					
1329	B	70,094	2					
1329	B	70,098	2					
1329	B	70,146	3					
1329	B	70,147	2					
1329	B	70,161	3					
1329	B	70,188	2					
1,329	B	70,191	3					
1,329	B	70,195	3					
1329	B	70,198	2					
1329	B	70,200	2					
1329	B	70,210	3					
1329	B	70,223	3					
1329	B	00,237	2					
1329	B	00,241	2					
1329	B	00,248	3					
1329	B	00,256	3					
1329	B	00,263	3					
1329	B	00,272	3					
1329	B	00,273	2					
1329	B	00,290	3					
Broward Hall	O	70,088	3					
Broward Hall	O	70,111	3					
Broward Hall	O	70,166	2					
Broward Hall	O	70,196	2					
Broward Hall	O	70,199	2					
Broward Hall	O	00,174	3	0500-1330				
Broward Hall	O	00,247	3					
Broward Hall	O	00,267	2					
Broward Hall	O	00,268	3					
C.L.B.	O	70,010	2					
C.L.B.	O	70,013	3					
C.L.B.	O	70,032	3					
C.L.B.	O	70,033	3					
C.L.B.	O	70,043	3	0500-1330				
C.L.B.	O	70,046	3					
C.L.B.	O	70,053	3					
C.L.B.	O	70,055	3					
C.L.B.	O	70,056	3					
C.L.B.	O	70,062	3					
C.L.B.	O	70,065	2					
C.L.B.	O	70,073	3					
C.L.B.	O	70,079	3					
C.L.B.	O	70,081	3					
C.L.B.	O	70,083	3	0500-1330				
C.L.B.	O	70,084	3					
C.L.B.	O	70,087	3	0500-1330				
C.L.B.	O	70,091	3					

C.L.B.	O	70,140	3					
C.L.B.	O	70,145						
C.L.B.	O	70,156	3					
C.L.B.	O	70,158	3					
C.L.B.	O	70,204	3					
C.L.B.	O	70,211	3					
C.L.B.	O	70,215	3					
C.L.B.	O	00,246	3					
C.L.B.	O	00,255	3					
C.L.B.	O	00,260	3	0500-1330				
C.L.B.	O	00,282	3					
Criser Hall	O	70,004	2					
Criser Hall	O	70,008	3					
Criser Hall	O	70,029	3					
Criser Hall	O	70,031	3					
Criser Hall	O	70,052	3					
Criser Hall	O	70,067	3					
Criser Hall	O	70,071	3					
Criser Hall	O	70,078	3					
Criser Hall	O	70,096	2					
Criser Hall	O	70,119	3					
Criser Hall	O	70,122	2					
Criser Hall	O	70,130	3					
Criser Hall	O	70,162	3					
Criser Hall	O	70,201	2					
Criser Hall	O	70,218	3					
Criser Hall	O	70,219	3					
Criser Hall	O	70,228	3					
Criser Hall	O	70,230	2					
Criser Hall	O	70,231	3					
Criser Hall	O	00,250	3					
Criser Hall	O	00,257	3					
Criser Hall	O	00,259	3					
Criser Hall	O	00,262	3					
Criser Hall	O	00,270	2					
Criser Hall	O	00,271	3					
Criser Hall	O	00,277	2	0500-1330				
Criser Hall	O	00,288	2					
Fine Arts	O	70,012	2	0500-1330				
Fine Arts	O	70,027	3					
Fine Arts	O	70,036	3	0500-1330				
Fine Arts	O	70,212	3					
Garage 3 L1	B	70,069	3					
Garage 3 L1	B	70,110	3					
Garage 3 L1	B	70,134	3					
Garage 3 L1	B	70,171	3					
Garage 3 L1	B	70,172	3					
Garage 3 L1	B	70,178	3					
Garage 3 L1	B	70,179	3					
Garage 3 L1	B	70,202	2					
Garage 3 L1	B	70,229	2					
Garage 3 L1	B	00,254	3					
Garage 3 L3	B	70,003	3					

Garage 3 L3	B	70,011	2	1300-2330				
Garage 3 L3	B	70,014	3					
Garage 3 L3	B	70,022	2					
Garage 3 L3	B	70,034	3					
Garage 3 L3	B	70,064	2					
Garage 3 L3	B	70,089	3					
Garage 3 L3	B	70,099	2					
Garage 3 L3	B	70,121	3					
Garage 3 L3	B	70,131	3					
Garage 3 L3	B	70,135	3					
Garage 3 L3	B	70,138	3					
Garage 3 L3	B	70,141	2					
Garage 3 L3	B	70,148	3					
Garage 3 L3	B	70,152	3					
Garage 3 L3	B	70,157	2					
Garage 3 L3	B	70,164	2					
Garage 3 L3	B	70,167	4					
Garage 3 L3	B	70,170	3					
Garage 3 L3	B	70,177	3					
Garage 3 L3	B	70,186	2	1530-2400				
Garage 3 L3	B	70,187	2					
Garage 3 L3	B	70,190	2					
Garage 3 L3	B	70,203	2					
Garage 3 L3	B	70,205	2					
Garage 3 L3	B	70,207	2					
Garage 3 L3	B	70,208	2					
Garage 3 L3	B	70,214	3					
Garage 3 L3	B	70,217	3					
Garage 3 L3	B	70,220	3					
Garage 3 L3	B	70,221	3					
Garage 3 L3	B	70,233	3	1200-2230				
Garage 3 L3	B	70,234	3					
Garage 3 L3	B	70,235	3					
Garage 3 L3	B	00,242	3	After 2:30pm				
Garage 3 L3	B	00,252	2					
Garage 3 L3	B	00,261	3					
Garage 3 L3	B	00,265	2					
Garage 3 L3	B	00,274	2	1200-2400				
Garage 3 L3	B	00,278	2					
Garage 3 L3	B	00,280	3					
Inf. South	O	70,006	2					
Inf. South	O	70,040	2					
Inf. South	O	70,045	3					
Inf. South	O	70,048	3					
Inf. South	O	70,139	2					
Inf. South	O	70,194	2					
Inf. South	O	00,239	3					
Library West	O	70,112	3	0500-1330				
Library West	O	70,116	2					
Library West	O	70,127	3					
Library West	O	70,169	3					
Library West	O	70,193	3					
Library West	O	70,206	3	0500-1330				

Library West	O	70,225	3					
Library West	O	00,244	3					
Library West	O	00,275	2					
Library West	O	00,279	3					
Library West	O	00,281	3					
McCarty Dr.	O	00,258	2					
McCarty Drive	O	70,216	3	0500-1330				
McCarty Hall	O	70,005	2					
McCarty Hall	O	70,016	3					
McCarty Hall	O	70,044	3					
McCarty Hall	O	70,085	2					
McCarty Hall	O	70,133	3					
McCarty Hall	O	70,159	3					
McCarty Hall	O	70,165	2					
McCarty Hall	O	00,236	3					
McCarty Hall	O	00,266	3					
Union Rd	O	70,035	3					
Union Rd	O	70,070	3					
Union Rd	O	70,080	3					
Union Rd	O	70,107	2					
Union Rd	O	70,155	3					
Union Rd	O	70,160	3					
Union Rd	O	70,185	3					
Union Rd	O	70,189	2					
Union Rd	O	70,224	3					
Union Rd	O	00,251	3					
Union Rd	O	00,285	3					
Union Rd	O	00,286	3					
Union Rd. West	O	70,075	3					
Union Rd. West	O	70,181	3	0500-1330				
Union Rd. West	O	00,287	3					

Appendix 2

Survey of Carpool Program Members

SURVEY OF CARPOOL PROGRAM PARTICIPATION, UNIVERSITY OF FLORIDA

Your response to this survey will help us evaluate how effective the carpool program at the University of Florida has been as an alternative transportation program from the perspectives of the university, the surrounding community, and the participants of the carpool program. It will also help us evaluate recommendations that could potentially improve the effectiveness of the program.

Please read each question very carefully prior to responding to ensure the most accurate results. For purposes of this survey, carpooling occurs when two or more commuters (regardless of place of work) occupy a single vehicle while traveling from home to work, or from work to home.

We thank you for taking the time to fill out this survey!

PART A. In this first section, we would like to obtain some background information before your participation with the carpool program.

1. How many days per week did you use the following types of transportation to go to work BEFORE you began participating in the carpool program at the University of Florida (UF)? Please provide your answers in the spaces below, and account for times when you used more than one method of transportation to travel to work during a given day. If you did not use a particular method, leave the space blank.

	Number of Days ↓	
I DROVE ALONE	_____	DAYS PER WEEK
I CARPOOLED	_____	DAYS PER WEEK
I WAS DROPPED OFF BY A FRIEND OR RELATIVE	_____	DAYS PER WEEK
I RODE THE BUS	_____	DAYS PER WEEK
I RODE A BICYCLE	_____	DAYS PER WEEK
I WALKED	_____	DAYS PER WEEK
I WORKED AT HOME	_____	DAYS PER WEEK
I USED SOME OTHER METHOD NOT LISTED ABOVE (Please specify below):		
_____	_____	DAYS PER WEEK

2. How did you first become aware of the university's carpool program? Please circle your answer:

1. Relative
2. Friend
3. Neighbor
4. Co-worker
5. New employee orientation
6. Transportation and Parking Services office
7. Transportation and Parking Services website
8. University newspaper, circular, publication, or other advertisement
9. Other method (please specify) _____

3. How did you identify other members of your carpool group? Please circle your answer(s); select more than one if applicable:

1. Relative
2. Friend
3. Neighbor
4. Co-worker
5. Campus Carpool Classified in Transportation and Parking Services website
6. Advertisement, bulletin board, or classified in location other than website
7. Other method (please specify) _____

PART B. In this section, we would like to find out some personal information and other pertinent information applicable to your current participation with the carpool program.

4. How many miles is it from your home to place of work? Please estimate if you are not exactly sure:

(One way distance only) _____ miles

5. Do you live in Alachua County? Please circle your answer:

1. Yes
2. No, please indicate county in which you live: _____

6. Do you carpool with someone who lives at your home address? Please circle your answer:

1. Yes
2. No

7. What are your standard work hours? Please state the appropriate times and circle AM or PM as applicable. Circle Yes or No based on whether or not your work hours are flexible:

Starting Time: _____ AM / PM

Ending Time: _____ AM / PM

Are your work hours flexible? Yes / No

8. How many days per week do you commute to work? _____ days

9. How many months out of the year are you employed? _____ months

10. Since its inception in 1997, how long have you been a participant in the carpool program at UF? Please include all time participating in all carpool groups, not just your current carpool group.

Please enter approximate years and months: _____ years _____ months

11. If you DID NOT participate in the carpool program, would you purchase a University of Florida parking decal? Please circle your answer:

1. No
2. Yes

↓

If yes, what type of decal would you purchase? Please circle your answer:

1. Staff Commuter
2. Orange or Blue
3. Official Business
4. Gated Parking
5. Official Gated
6. Motorcycle
7. Other (please specify): _____

PART C. In this section, we want to find out specific information regarding your actual carpool trips to work.

12. How many days during the week do you DRIVE from your home to meet other members in your carpool? Note that being a passenger in a vehicle on a given day does not qualify as being a driver for that day. Please circle your answer:

1. None
2. 1 day
3. 2 days
4. 3 days
5. 4 days
6. 5 days
7. More than 5 days

↓

If your answer is one day or more, please estimate how far you drive to meet other members in your carpool:

_____ miles

13. How many days during the week are you the DRIVER of your group's carpool vehicle (that travels to work and parks in your group's reserved parking space) after meeting all other members of your carpool? Note that being a passenger in the carpool on a given day does not qualify as being the driver for that day. Please circle your answer:

1. None
2. 1 day
3. 2 days
4. 3 days
5. 4 days
6. 5 days
7. More than 5 days

If your answer is one day or more, please estimate how far you drive to work after meeting the other members in your carpool:

_____ miles

14. How many days during the week are you dropped off at your work location before your group's carpool vehicle reaches its assigned parking space? Please circle your answer:

1. None
2. 1 day
3. 2 days
4. 3 days
5. 4 days
6. 5 days
7. More than 5 days

15. During the day, do you use the carpool vehicle for any purpose? Please circle your answer:

1. Yes
2. No

Please continue on to the next page!

Part D. In this section, we want to find out how important you view the various benefits of the carpool program and any other factors that may affect your decision to carpool.

16. How important are each of the following factors in influencing your decision to participate in the university's carpool program? Please circle the level of importance for each factor:

1 = Not Important 2 = Little Importance 3 = Some Importance
4 = Very Important 5 = Highest Importance

Please circle the level of importance for each factor:

	Not Important				**Highest Importance**
I do not own a vehicle	1	2	3	4	5
I save money on gas and vehicle maintenance	1	2	3	4	5
I save money on parking	1	2	3	4	5
I receive a savings in travel time	1	2	3	4	5
I receive a priority parking location	1	2	3	4	5
I receive a guaranteed parking space	1	2	3	4	5
I am able to commute and park individually four days per semester when I am unable to carpool	1	2	3	4	5
I am guaranteed a ride home in the event of an unexpected emergency during business hours	1	2	3	4	5
In the event I am required to work late, reimbursement for cab fare home is authorized	1	2	3	4	5
I knew the other members in my carpool before joining the carpool program	1	2	3	4	5
Carpooling provides an opportunity to socialize with others	1	2	3	4	5
My carpooling arrangement is convenient	1	2	3	4	5
Carpooling offers time to read, relax, or work during the trip	1	2	3	4	5
Carpooling is beneficial for the community	1	2	3	4	5

17. Please indicate any other benefits or factors that have influenced your decision to participate in the university carpool program in the space provided below:

Part E. In this section, we would like to find out your potential willingness to continue participating the carpool program at UF if certain policies were implemented or changed. The possible changes identified in this section have been taken from elements of carpool programs used at other universities nationwide.

18. How willing would you be to continue participating in the UF carpool program under the conditions identified below? Please circle your level of willingness for each one:

1 = Very Unwilling 2 = Somewhat Unwilling 3 = Neutral
4 = Somewhat Willing 5 = Very Willing

	Please circle your level of willingness to continue participating under the identified conditions: **Very Unwilling**				**Very Willing**
The University would match me with an employee that lives close to my home (or within an efficient commute path) and has a compatible work schedule.	1	2	3	4	5
The price for carpool permits would no longer be free but substantially discounted from the regular price for parking decals.	1	2	3	4	5
Reserved carpool spaces would no longer be chosen by the carpool groups but clustered in parking areas within a maximum 10 minute walk or bus ride to my work location.	1	2	3	4	5
The University would closely monitor carpools to ensure that a minimum number of participants are present in each carpool vehicle every day.	1	2	3	4	5
The University would provide reserved parking spaces for daily carpoolers, with a reduction in the cost of parking on those days.	1	2	3	4	5
The University would substantially decrease the number of regular employee parking spaces (orange, blue, and official business) available on campus.	1	2	3	4	5
The University would substantially raise the price for regular employee parking decals (orange, blue, and official business).	1	2	3	4	5

19. Please indicate any particular dislikes you have about the carpool program:

20. What do you think the university could do to improve the overall effectiveness of the program? Please indicate any additional comments you would like to add about the university carpool program here as well.

PART F. Demographic Information (for statistical purposes only). Please circle your answers.

21. How would you classify your position at the University of Florida?

1. Faculty
2. Staff
3. Post Doctoral Associate
4. OPS Professional
5. Shands employee
6. Other (please specify) _____

22. What is your age?

1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. Over 65

23. What is your sex?

1. Male
2. Female

24. What is your race? (Categories taken from U.S. Census Bureau)

1. White
2. Black
3. American Indian, Eskimo, or Aleut
4. Asian or Pacific Islander

Are you of Hispanic origin? Yes / No (please circle one)

25. What is your marital status?

1. Married
2. Single
3. Divorced
4. Separated
5. Widowed

26. How many children under the age of 18 live in your home?

1. None
2. One
3. Two
4. Three
5. More than three (please specify) _____

If one or more, please indicate age(s): _____

27. What was your household income for calendar year 1999?

1. Less than $20,000
2. $20,000 to $34,999
3. $35,000 to $49,999
4. $50,000 to $64,999
5. $65,000 to $79,999
6. $80,000 and above

28. What is your education level?

1. Less than high school degree
2. High school or graduate equivalent degree
3. Some college
4. Undergraduate college degree
5. Master's or professional degree
6. Ph.D., M.D., or other terminal degree

Should you have any questions about this survey or the project in general, please contact Dr. Ruth L. Steiner, Dr. Paul D. Zwick, or Mr. Jonathan B. Siegel at (352) 392-0997 (fax: 2-3308), or you may write or e-mail us at the following addresses:
PO Box 115706, University of Florida
Department of Urban and Regional Planning
Gainesville, FL 32611-5706
E-mail: rsteiner@ufl.edu; paul@geoplan.ufl.edu; jsiegel@ufl.edu

Thanks again for your participation!

Appendix 3

Approved Informed Consent Protocol

Appendix 4

Results of Analysis Figures and Tables

FIGURE 1

Carpools Within 1-mile of Contiguous UF Boundary

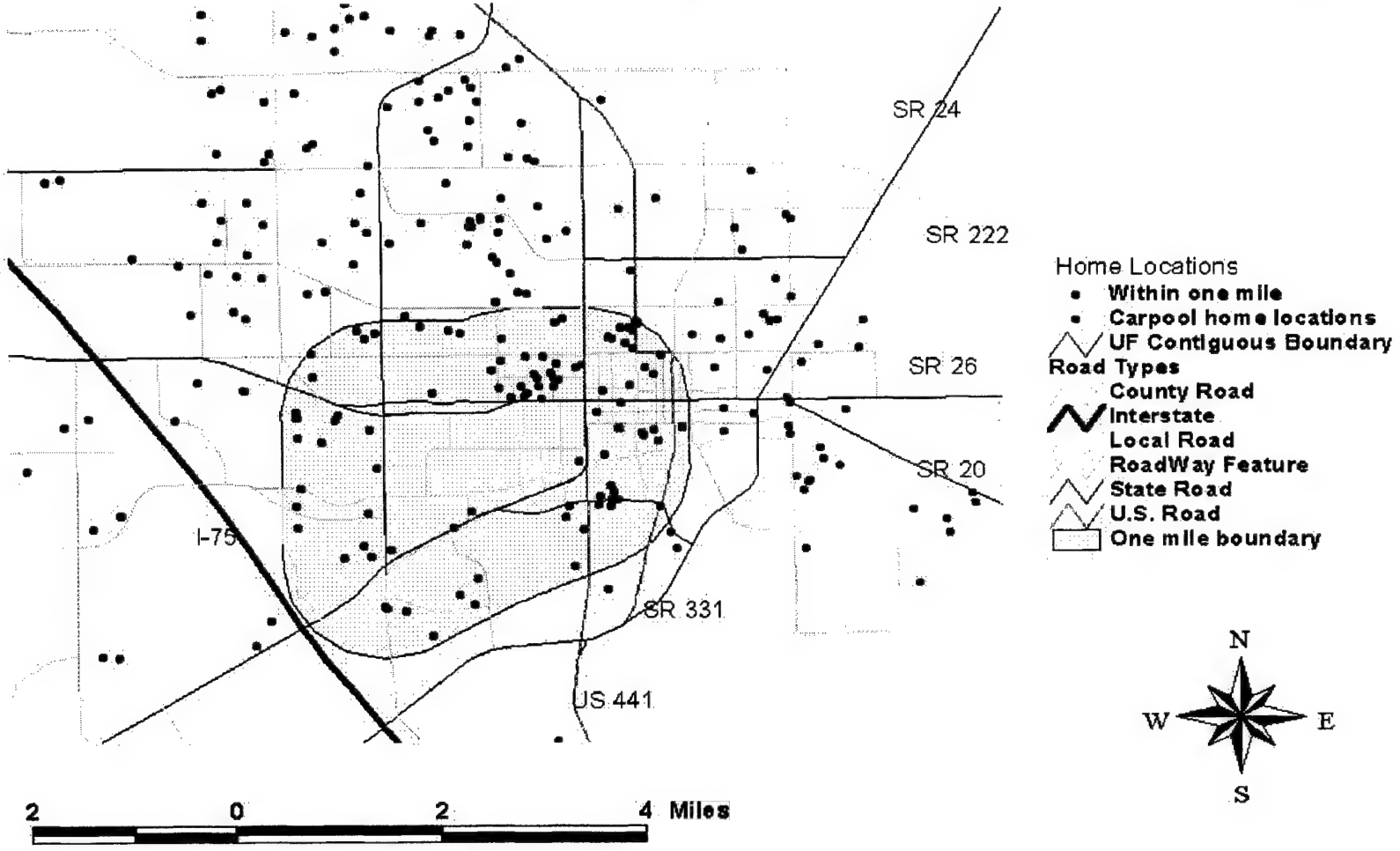

FIGURE 2

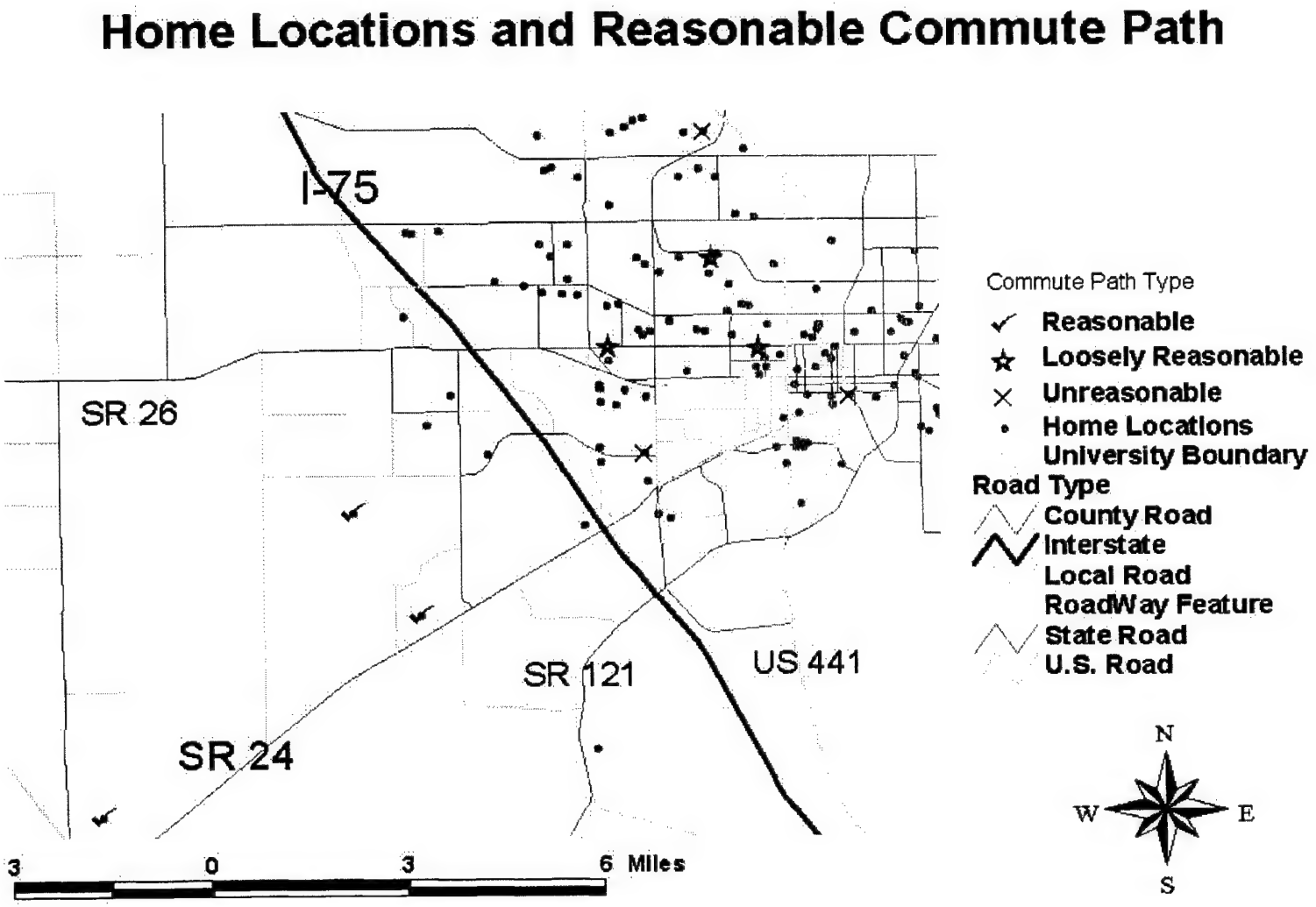
Home Locations and Reasonable Commute Path
I-75
SR 26
SR 121
US 441
SR 24
3 0 3 6 Miles
Commute Path Type
Reasonable
Loosely Reasonable
Unreasonable
Home Locations
University Boundary
Road Type
County Road
Interstate
Local Road
RoadWay Feature
State Road
U.S. Road
N
W
E
S

FIGURE 3

Loosely Reasonable and Unreasonable Commute Paths

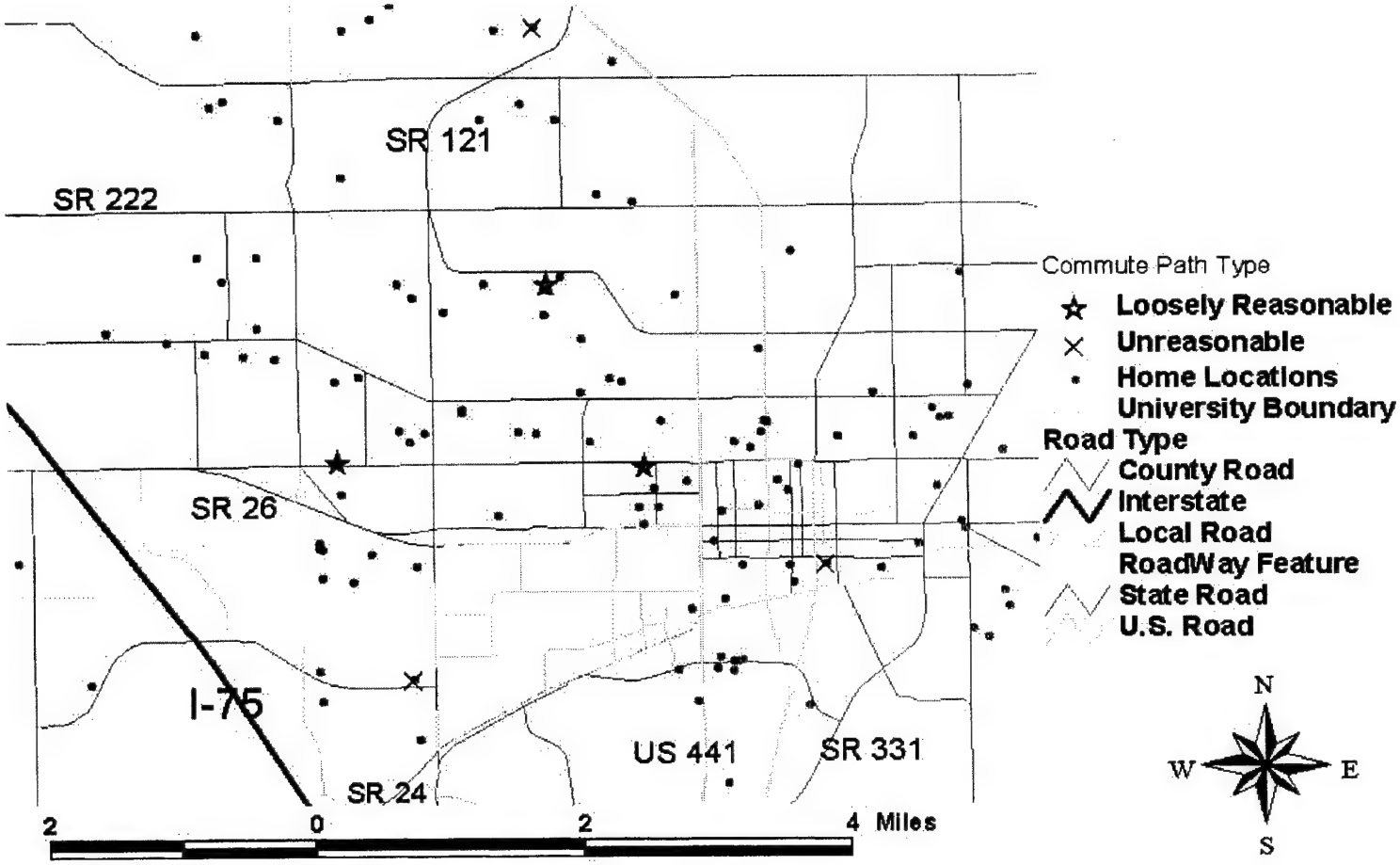

Table A.1 – UF Transportation and Parking Services Current Spaces & Demand Database

	Orange & Blue Permits	Official Business Permits	Orange Spaces	Blue Spaces	Non-Reserved Permits	Non-Reserved Spaces	Non-Reserved Oversell	Gated Permits	Gated Spaces	Gated Oversell	Carpool Permits/ Spaces	Total Employee Permits	Total Employee Spaces	Total Employee Oversell
Sep-96	5,620	3,130	3,939	2,414	8,750	6,353	1.38	1,613	1,443	1.12	0	10,363	7,796	1.33
Sep-97	5,692	3,002	3,765	2,529	8,694	6,294	1.38	1,623	1,359	1.19	90	10,407	7,743	1.34
Sep-98	5,469	2,904	3,513	2,274	8,373	5,787	1.45	1,542	1,513	1.02	180	10,095	7,480	1.35
Jan-99	5,750	3,000	3,513	2,274	8,750	5,787	1.51	1,671	1,513	1.10	191	10,612	7,491	1.42
Sep-99	5,955	2,662	3,513	2,274	8,617	5,787	1.49	1,899	1,513	1.26	232	10,748	7,532	1.43
Jan-00	6,234	2,701	3,564	2,512	8,935	6,076	1.47	1,935	1,584	1.22	231	11,101	7,891	1.41
Change	+614	-429	-375	+98	+185	-277	**+0.09**	+322	+141	+0.10	+231	+748	+95	**+0.08**
	Brown Permits	Brown Spaces	Red Permits	Red Spaces	Red Oversell	Park and Ride Permits	Park and Ride Spaces	Commuter Permits	Commuter Spaces	Commuter Oversell	All Decal Spaces	Total Student Permits	Total Student Spaces	Total Student Oversell
Sep-96	842	1,067	4526.00	3,214	1.41	1558.00	391	11,799	4,247	2.78	1799.00	18,725	10,718	1.75
Sep-97	731	959	4509.00	3,217	1.40	1336.00	433	11,786	4,437	2.66	1875.00	18,362	10,921	1.68
Sep-98	706	957	3802.00	3,216	1.18	1272.00	431	11,806	4,434	2.66	2181.00	17,586	11,219	1.57
Jan-99	754	957	4313.00	3,216	1.34	1129.00	431	12,419	4,434	2.8	2181.00	18,615	11,219	1.66
Sep-99	719	957	4356.00	3,216	1.35	1060.00	431	12,184	4,434	2.75	2181.00	18,319	11,219	1.63
Jan-00	772	957	4571.00	3,282	1.39	884.00	477	12,411	4,145	2.99	2789.00	18,638	11,650	1.6
Change	-70	-110	+45	+68	-0.02	-674	+86	+612	-102	**+0.21**	+990	-87	+932	**-0.15**

	Total Permits	Total Spaces	Total Oversell
Sep-96	29,088.00	18,514	1.57
Sep-97	28,769	18,664	1.54
Sep-98	27,681	18,699	1.48
Jan-99	29,227	18,710	1.56
Sep-99	29,067	18,751	1.55
Jan-00	29,739	19,541	1.52
Change	+651	+1,027	**-0.05**

Note: Obtained from Transportation and Parking Services Decal Office

Table A.2 Median Average Daily Traffic in Gainesville, UF, and surrounding areas

Highway	Street	From	To	LOS	1999	1996	1991
	ARTERIALS						
24	SW Archer Rd	I-75	SW 16th Ave	C	52,550	45,000	36,680
24	SW Archer Rd	SW 16th Ave	SW 13th St	D	29,000	29,500	24,665
26	Newberry Rd	NW 8th Ave	W 34th St	B	32,500	31,750	28,435
26	W University Ave	W 34th St	North-South Dr	B	28,250	26,250	27,605
26	W University Ave	North-South Dr	SW 13th St	E	34,500	36,500	27,010
26	University Ave	W 13th St	Waldo Rd	B	21,250	22,750	21,540
26A	SW 2nd Ave	Newberry Rd	SW 34th St	E	16,300	15,400	16,945
26A	SW 2nd Ave	SW 34th St	W University Ave	C	14,750	15,250	13,085
441	SW 13th St	Williston Rd	SW Archer Rd	B	23,500	24,000	21,370
441	SW 13th St	SW Archer Rd	W University Ave	F	38,250	39,000	32,800
441	SW 13th St	W University Ave	NW 29th Rd	F	34,000	33,250	28,605
226	SW 16th Ave	SW Archer Rd	SW 13th St	A	21,900	19,850	19,740
226	SW 16th Ave	SW 13th St	S Main St	-	19,250	19,050	17,850
121	SW 34th St	Williston Rd	SW Archer Rd	B	26,153	21,800	18,585
121	SW 34th St	SW Archer Rd	W University Ave	D	44,000	40,750	34,410
121	NW 34th St	W University Ave	NW 16th Ave	F	22,750	22,000	24,000
	UNIVERSITY			**SUM**	**460,902**	**444,096**	**393,325**
	North-South Drive	SW Archer Rd	Museum Rd	D	*14,881*		
	North-South Drive	Museum Rd	W University Ave	F	*11,627*		
	North-South Drive	SW Archer Rd	W University Ave	-	*13,254	13,211	n/a
	Hull-Mowry Rd	SW 34th St	Center Dr	F	12,534	14,911	n/a
	Radio-Museum Rd	SW 34th St	SW 13th St	E	10,646	10,594	n/a
	CITY/COUNTY			**SUM**	**36,434**	**38,716**	**^n/a**
	SW 20th Ave	SW 62nd Blvd	SW 34th St	C	23,400	22,943	21,960
	NW 8th Ave	Newberry Rd	NW 22nd St	B	15,752	15,840	14,145
	NW 8th Ave	NW 22nd St	NW 6th St	E	14,773	13,810	15,095
	NW 8th Ave	NW 6th St	Waldo Rd	D	9,508	9,590	10,380
	S 4th Ave	SW 13th St	SE 15th St	D	5,212	5,091	4,965
	NW 22nd St	NW 16th Ave	W University Ave	C	5,852	5,852	4,940
	NW 17th St	NW 8th Ave	W University Ave	D	5,147	4,992	4,755
	W 6th St	NW 8th Ave	SW 4th Ave	D	7,014	7,023	6,915
	W 6th St	SW 4th Ave	SW 16th Ave	D	6,269	5,549	3,405
	SW 23rd Terrace	Williston Rd	SW Archer Rd	D	10,676	7,820	n/a
				SUM	**103,603**	**98,510**	**86,560**

* In 1998, North-South Drive was widened to four lanes between Archer and Museum Roads. Prior to this, ADT was calculated over the entire length of the road. After the road was widened, ADT was calculated in two separate segments. The 13,254 figure for 1999 is the average ADT of both segments of North-South Drive.

^ n/a means that ADT was not calculated for that specific road segment during the applicable time period.

Note: Obtained from the North Central Florida Regional Planning Council and Gainesville 1991-2001 Comprehensive Plan

Table B.1 – Tests for significance between carpool population and survey responses

Category	Population	Number	Survey	Number	Z-Value	Significant (.95-Level)
Carpool Size						
Two-person	25.4%	621	29.2%	178	1.16	N
Three-person	73.9%	621	70.2%	178	-1.12	N
Four-person	0.6%	621	0.6%	178	0	N
Sex/Gender						
Male	38.85%	646	33%	188	-1.65	N
Female	61.15%	646	67%	188	1.65	N
Race						
White	63.1%	583	81.4%	188	**5.2**	**Y**
Black	18.0%	583	7.4%	188	**-3.8**	**Y**
Asian/P.I.	16.8%	583	10.1%	188	**-2.46**	**Y**
Hispanic	2.1%	583	6.9%	72	N/A	N
Indian/Other	0.5%	583	1.1%	188	1.17	N
Age						
24 and Under	2.6%	586	2.1%	188	-0.43	N
25 – 34	24.4%	586	23.9%	188	-0.16	N
35 – 44	32.8%	586	28.7%	188	-1.2	N
45 – 54	26.8%	586	30.3%	188	1.1	N
55 – 64	12.1%	586	13.8%	188	0.71	N
65 & Over	1.4%	586	1.1%	188	-0.35	N
Job Classification						
Faculty	12.2%	637	15.9%	189	1.55	N
Staff	65.8%	637	68.3%	189	0.72	N
Post Doc Associate	7.1%	637	2.6%	189	-2.41	Y
OPS Prof	4.1%	637	3.7%	189	-0.28	N
Shands	10.7%	637	9.0%	189	-0.76	N
Education Level						
L.T. High School	3.2%	571	2.1%	183	-0.85	N
High School	33.5%	571	21.4%	183	**-3.47**	**Y**
College	35.6%	571	45.9%	183	**2.91**	**Y**
Some College	*19.1%*	*571*	*28.3%*	*183*	***3.17***	***Y***
Undergrad Degree	*16.5%*	*571*	*17.6%*	*183*	*0.40*	*N*
Graduate School	8.4%	571	15.5%	183	**3.46**	**Y**
Doctor/Professional	19.4%	571	15.0%	183	-1.5	N
Months Worked						
Under 12 months	5.6%	572	5.3%	189	-0.2	N
12 months	94.4%	572	94.7%	189	0.2	N
Full-Time Status						
Non-FT Status	11.5%	566	10.8%	166	-0.3	N
Full-Time Status	88.5%	566	89.2%	166	0.3	N
Parking Locations						
Main Campus	61.7%	619	70.8%	178	**2.5**	**Y**
Shands Hospital	35.2%	619	26.4%	178	**-2.5**	**Y**

Commuter/All Decal	3.1%	619	2.8%	178	-0.2	N
Home vs. Non-Home						
Household Based	32%	646	39.7%	189	**2.27**	**Y**
Non-HH Based	68%	646	60.3%	189	**-2.27**	**Y**
City of Origination						
Gainesville	58.5%	646	55%	189	-0.98	N
Outside Gainesville	41.5%	646	45%	189	0.98	N
County of Origination						
Alachua	67%	609	64%	189	-0.88	N
Outside Alachua	33%	609	36%	189	0.88	N
Home-to-Work or Household Distance						
Average	13.66 miles	626	16.8 miles	189	**2.99** (sd = 14.45)	**Y**
Median	6.8 miles		10 miles			
1 mile or less	4.5%	626	1.6%	189	**-1.92**	**Y**
1.1 – 5 miles	37.1%	626	33.3%	189	-1.08	N
5 miles or less	*41.6%*	*626*	*34.9%*	*189*	***-1.87***	***Y***
5.1 – 10 miles	16.0%	626	15.9%	189	0.04	N
10.1 – 15 miles	4.3%	626	5.3%	189	0.68	N
15.1 – 20 miles	6.1%	626	4.2%	189	-1.09	N
20.1 – 30 miles	18.4%	626	22.8%	189	1.56	N
Over 30 miles	13.6%	626	16.9%	189	1.32	N

1. For nominal data, Z = (survey percentage - population percentage) / (square root of [population percentage x (1 – population percentage) / number of survey responses])
2. For continuous data, Z = (survey mean – population mean) / (standard deviation / square root of number of survey responses)

Table B.2 – Savings in oversell ratio as a result of the carpool program

	Orange & Blue Permits	Official Business Permits	Orange Spaces	Blue Spaces	Non-Reserved Permits	Non-Reserved Spaces	Non-Reserved Oversell	Gated Permits	Gated Spaces	Gated Oversell	Carpool Permits/ Spaces	Total Employee Permits	Total Employee Spaces	Total Employee Oversell
Current	6,234	2,701	3,564	2,512	8,935	6,076	1.47	1,935	1,584	1.22	233	11,103	7,893	1.41
W/o Program	6,534	2,827	3,704	2,596	9,361	6,300	1.49	1,980	1,584	1.25	0	11,341	7,884	1.44
	On-Campus Housing Permits	On-Campus Housing Spaces	On-Campus Oversell	Park and Ride / Commuter Permits	Park and Ride / CT/ All Decal Spaces	Park and Ride / CT/ All Decal Oversell	Perimeter and Housing Permits	Perimeter and Housing Spaces	Perimeter and Housing Oversell		Overall Employee, Perimeter, Housing:	Permits	Spaces	Oversell
Current	5,343	4,239	1.27	13,295	7,411	1.79	18,638	11,650	1.60			29,741	19,543	1.52
W/o Program	5,343	4,239	1.27	13,346	7,420	1.80	18,689	11,659	1.60			30,030	19,543	1.54

Table B.3 – Increase in the price of parking decals, 1995 - 2000

	Gated Official Business		Gated		Reserved		Official Business		Orange or Blue		Staff Commuter		Student (Commuter or On-Campus Housed)	
	per month	annual	per month	annual	per month	annual	per month	annual	per month	annual	per month	annual	per month	annual
May-95	35.00	420.00	32.17	386.00	21.83	262.00	13.33	160.00	10.33	124.00	5.00	60.00	5.00	60.00
May-97	36.83	442.00	33.67	404.00	22.83	274.00	14.00	168.00	10.83	130.00	5.33	64.00	5.33	64.00
May-00	47.50	570.00	43.50	522.00	29.50	354.00	18.00	216.00	14.00	168.00	7.00	84.00	6.50	78.00
Change	12.50	150.00	11.33	136.00	7.67	92.00	4.67	56.00	3.67	34.00	2.00	24.00	1.50	18.00
Annual %		5.2%/yr		5.2%/yr		5.1%/yr		5.1%/yr		5.2%/yr		5.8%/yr		4.5%/yr

Note: Information obtained from UF Traffic and Parking Rules and Regulations

Table B.4 – Importance of UF carpool program features and benefits

	Responses	Not (1)	Some (2)	Medium (3)	Very (4)	Most (5)	Average	Non-Response	Didn't Understand
Guaranteed Parking Space	182	2.2%	0%	2.2%	11.0%	84.6%	4.76	3.7%	0
Priority Parking Location	179	3.4%	0%	6.1%	16.2%	74.3%	4.58	4.8%	0.5%
Save $ Parking	186	5.9%	2.2%	7.0%	21.5%	63.4%	4.34	1.6%	0
Arrangement is Convenient	185	4.3%	2.7%	16.8%	30.8%	45.4%	4.1	2.1%	0
Beneficial to Community	186	5.4%	2.2%	24.7%	26.9%	40.9%	3.95	1.6%	0
Previously Knew Members	183	8.7%	6.6%	18.0%	30.6%	36.1%	3.78	3.2%	0
4 Passes to Park Individually	179	10.6%	6.1%	17.3%	29.6%	36.3%	3.74	4.8%	0.5%
Emergency Ride Home	181	14.9%	11.6%	18.8%	25.4%	29.3%	3.42	4.2%	0
Save $ Gas / Maintenance	181	21.5%	7.7%	17.7%	25.4%	27.6%	3.29	4.2%	0
Reimbursed Ride Home	174	28.2%	12.6%	21.8%	19.5%	17.8%	2.85	6.9%	1.1%
Opportunity to Socialize	184	31.5%	19.0%	23.9%	12.5%	13.0%	2.55	2.6%	0
Save Commute Time	174	37.9%	14.9%	19.5%	10.3%	17.2%	2.53	7.4%	0.5%
Time to Read, Relax or Work	186	41.9%	17.7%	21.5%	8.1%	10.8%	2.26	1.6%	0
Own Vehicle	156	77.6%	3.8%	3.2%	8.3%	7.1%	1.61	17.5%	0

Table B.5 – Willingness of participants to continue participating in the carpool program if changes are made.

	Responses	Very Unwilling (1)	Somewhat Unwilling (2)	Neutral (3)	Somewhat Willing (4)	Very Willing (5)	Average	Non - response	Didn't Understand
Monitor participation	179	21.2%	9.5%	35.2%	11.2%	22.9%	3.04	4.8%	0.5%
Decrease spaces	180	31.9%	8.6%	26.1%	13.3%	20.0%	2.80	4.2%	0.5%
Daily reserved carpooling	165	26.1%	12.7%	35.8%	11.5%	13.9%	2.73	4.2%	8.5%
Increase regular decal price	180	38.3%	10.6%	15.6%	13.9%	21.7%	2.69	3.7%	1.1%
Match participants	180	29.4%	20.6%	23.9%	9.4%	16.7%	2.62	4.8%	0%
Discounted permits	175	32.6%	18.3%	21.7%	13.1%	14.3%	2.57	6.9%	0.5%
Spaces no longer chosen	184	60.9%	19.6%	13.0%	4.3%	2.2%	1.66	2.6%	0%

Appendix 5

Summary of University Demographic, Parking, Carpool, and TDM Programs

Tables C.1 – Universities of Washington and Cornell University

	University of Washington – Seattle	**Cornell University**
Students	35,062	19,000
Faculty/Staff	20,463	10,000
Affiliated Institutions	Not Included	Not Included
City Population	Over 500,000 (1993)	30,000
Metropolitan Population	Over 750,000 (1996)	100,000
Parking Spaces	11,363 (1999)	Over 11,000 (1993)
Parking Permits Sold	6,000 (1999) *20% decline for employees and 41% decline for students since 1990*	N/A
Parking Price	$582/year or $145.50/qtr *Over 100% increase in price since 1990*	Interior - $552-$591/yr. Intermediate - $427/-$431yr. Perimeter - $274/yr. Remote - Free (*50% increase in prices since 1991*)
Parking Limitations	Student passes limited by allocation of spaces to individual dormitories, and commuters on first-come, first serve basis (commuters can use daily pay lots) Employees are assigned lots by Parking Office	Price is biggest disincentive per Communications Manager Students not eligible for interior parking.
Carpool Permit Cost	Free with U-PASS: $32/quarter – student $44/quarter – employees ($176/yr)	Tiered System based on location and number of members in a group: 2 person – Free outer / $153-$157 intermediate / $279-$318 interior 3 person – Rebate outer / Free intermediate / $125-$165 interior 4 person – Rebate outer and intermediate / Free interior
Carpool Participation	4,761 Participants (1999) - 1,149 permit carpools - 919 daily carpools *33% increase in participants since 1990*	1,329 people in 631 rideshare groups (6/2000)
TDM, Rideshare, or Alt. Trans. Coordinator	Yes – Separate U-Pass Office	No, but share Transportation Planner with Campus Planning
Program Requirements	Work / drive together at least 3 days per week Live within a logical commute path of each other (carpool must not pass by campus to pick up members) Live outside the no-carpool zone (roughly one mile from campus)	
Rideshare Matching	Puget Sound Region	Commuter Connection in TDMP website and campus newspaper

Information & Marketing	Information from direct mail, comprehensive website, email notices, campus newspapers and newsletters, kiosks at eight campus locations. The annual marketing effort includes a major fall quarter campaign when all students, faculty and staff receive the U-PASS User's Guide and other information, and a large transportation fair is held centrally on campus.	Commuter guides, pamphlets, circulars, advertisements, and TDMP website. Information provided during orientation, and during permit renewals.
Carpool Parking Locations	Permit spaces not reserved individually, but holders given priority lot assignments. Limited number of spaces available for ad-hoc/daily carpooling.	Reserved parking space for four-person groups, and three-person groups in perimeter parking locations. Members can pick any space in any tier/lot that they are eligible to park.
Other Benefits	Night Ride servicing nearby neighborhoods (over 38,000 trips per year), Merchant discounts Reimbursed rides home (used about 10 times/month) Free transit and university shuttle service	Emergency ride home 10 individual permits every 6 months (also free to commuters that do not purchase a decal) 16 park and ride locations in surrounding towns and villages
Monitor Participation	Parking Services notified when employee is dropped from payroll deduction.	Examine home addresses by hand to check legitimacy Payroll deduction of participants checked every pay period from human resources database
Other Results of Programs	Since 1990 (U-Pass): 12% reduction in AM vehicle trips to campus 4% reduction in PM vehicle trips leaving campus 1998 survey indicated 68% U-Pass participants very satisfied with program, 21% somewhat satisfied, and 68% use 2 or more U-Pass options. Mode splits – 29% transit, 27% walk, 25% drive alone, 12% carpool/vanpool, 6% bicycle.	Since implementation of TDMP: 26% reduction in vehicles brought to campus 10 million miles of travel reduced per year Over $4 million in savings by 1995, by not having to construct additional parking Winner of numerous environmental and energy awards for TDMP Program.
Other Notable Features	Prepares U-Pass Annual Report U-Pass funded 48% from user fees and 38% from parking fees: rideshare/matching: $206K; admin/monitoring: $345K; info/marketing: $218K U-Pass developed through heavy campus participation & education campaign	Worked with campus student, governmental, and employee groups and local communities to develop and refine program – over 80 public meetings held.

Table C.2 – Penn State University and University of Pittsburgh

	Pennsylvania State University	**University of Pittsburgh**
Students	41,500	30,000
Faculty/Staff	16,000	10,000
Affiliated Institutions	Not Included	12,000 from Medical Center
City Population	45,000	460,000
Metropolitan Population	100,000 (county)	2,000,000
Parking Spaces	16,665 (does not include airport or farm areas) Have approx. 1,000 more employee spaces than necessary, although there are localized shortfalls Surplus of 300 spaces for residence halls	4,700
Parking Permits Sold	Sell 2,800 permits for 1,984 space commuter lot, but run a space surplus of 500 during peak load. Assign on a 100% basis for core campus employee lots.	All lots full with a waitlist, available equally on first-come, first served basis. In some lots/garages, waitlists are as long as 2-3 years.
Parking Price	$312/yr ($30/mo.) – Interior garages (Restricted) $204/yr ($19/mo.) – Surface lots outside core $120/yr ($11/mo.) – Commuter lots	$70-$75 per month (Over $800/year) Private parking available in university district as high as $100 to $120 per month
Parking Limitations	Students under 28 credit hours	Limited number of spaces and high price. Limited parking for dorm students issued by a lottery.
Carpool Permit Cost	Regular decal cost shared among members	2 person carpools get $5/month discount per person 3 person carpools get $10/month discount per person 4 person carpools get $15/month discount per person
Carpool Participation	Only 5 official car/vanpools; however, CATA has matched over 100 people. Many informal carpools where neighbors share cost of driving.	225 – 250 participants in 18 vanpool groups 500 – 800 registered participants in 250 to 270 carpool groups
TDM, Rideshare, or Alt. Transportation Coordinator	No. Administration through Centre Area Transportation Authority (CATA).	Yes
Program/Eligibility Requirements	All members of a car pool may register their vehicle under one parking permit that may be transferred among car pool members.	Minimum of 2 people registered through Transportation Dept. must carpool a minimum of 3 days per week. 2-person carpools breaking up lose the permit
Rideshare Matching	CATA matches people throughout the county regardless of place of employment. Offers free custom ridematching lists.	Performed through the university ridesharing office. Printouts forwarded to people living near each other or along same route.
Information & Marketing	University publications, CATA, PSA's, and website	Actively advertise - brochures, flyers, "Take One" posters, bulk mailing, recruit from new hires at the weekly Pitt and Medical Center orientations, work at the annual benefits fairs, website, classified ads, radio, campus papers, and newsletters.

Carpool Parking Locations	No reserved spaces	Marked carpool spaces in most central, desirable garage on campus. Anyone with a carpool tag can use any one of the marked spaces (they are not named and numbered).
Other Benefits	No fare transit and campus loop shuttle system 3 one-day parking permits at no charge to accommodate occasional need to drive independently. Additional one-day permits cost $4/each. Emergency Ride Home	Extensive campus shuttle system and county-wide transit system are free when showing university identification (paid by student transportation fee). Guaranteed ride home with no limit for use and cost fully paid by university. Courtesy parking available 2 times per semester on days necessary to drive alone – call 24 hours in advance and courtesy space made avail. Park and Ride lots located around greater Pittsburgh area.
Monitor Participation	Receive monthly notification from payroll indicating whether members are still employed with the University.	Audit all participants every April. People found abusing program have permits revoked and pay a fine "Consistent enforcement is key to making sure you limit abusers and that the carpools are compliant with your policies" – Kathleen Miller
Other Results of Program		Mode split percentage stays about the same on a percentage basis. Studies conducted from time to time.
Other Notable Features	Population density high around campus and these individuals are served well by no-fare campus transit system or walking.	

Table C.3 – University of California – Davis and Riverside Campuses

	University of California - Davis	**University of California - Riverside**
Students	25,000	N/A
Faculty/Staff	10,000	N/A
Affiliated Institutions	Not Included	N/A
City Population	54,000	N/A
Metropolitan Population	1,000,000	N/A
Parking Spaces	10,050 (2000)	N/A
Parking Permits Sold	N/A	N/A
Parking Price	$492/yr for A-lot parking $396/yr for C-lot parking $204/yr for Remote parking $444/yr for Residence Hall parking	$468/yr ($117/qtr) for Premium (Red) $384/yr ($96/qtr) for Priority (Blue) $198/yr ($66/qtr) for General (Gold)
Parking Limitations	Price is biggest disincentive.	Students at UC Riverside are eligible to purchase permits based on availability. Also a wait list for Blue and Red permits for employees is based on availability.
Carpool Permit Cost	Per year: 2A - $168/person; 3A - $96/person 2C - $120/person; 3C - $72/person	Per Quarter: Red - $58.50/person Blue - $43.50/person
Carpool Participation	722 participants from 358 permits (63 of which are student permits) 216 spaces are reserved for permit holders	N/A
TDM, Rideshare, or Alt. Transportation Coordinator	Yes	Yes
Program/Eligibility Requirements	Two or more employees or students sharing one car on the majority of their commute trips to campus. Students must live outside of the Davis/El Macero area to participate in a registered carpool. A carpool application for the entire carpool must be completed. A payroll deduction authorization form must also be submitted for any faculty/staff member currently on payroll deduction and wishing to change the type of permit previously held or to enroll in payroll deduction. Carpool permits must be purchased for a minimum of one academic Quarter.	*Eligible to two or more full-time faculty, staff and graduate students who commute to campus. One Carpool Parking Permit is issued to the group for campus parking.* *When driving more than one vehicle to campus the same day, all participants must display either a carpool permit or alternative transportation permit.*
Rideshare Matching	Through TAPS office, with on-line access to Sacramento Area Council of Government's (SACOG) region-wide rideshare database. TAPS also offers personalized matching by attempting to match interested individuals to existing carpools.	Available through Riverside and San Bernadino Counties.

Information & Marketing	Transportation Centers are located throughout the UC Davis campus and contain transit and shuttle schedules, Alternative Transportation Program brochures, Emergency Ride Home brochures, Carpool Guidelines, Transitpool Program Guidelines, Bike Maps, "Spare The Air" brochures, and various other transportation related publications. Centers are updated weekly.	
Carpool Parking Locations	Reserved until 9am for A-lots and 9:30am for C-lots, at which time spaces become available for other permit holders. Up to two reserved spaces in the lot(s) of their choice. Certain lots have limited carpool parking, thus parking in these lots will be on a first-come, first-parked basis.	Carpool Permits are valid in all preferred or general parking lots. Premium Carpool Permits are valid in the premium lot that is indicated on the front of the permit, and all preferred or general lots. The carpool permit is valid in any carpool space within preferred lots, or preferred sections of multi assigned lots. If all carpool spaces are occupied, the carpool permit is valid in regular spaces in preferred or general parking lots.
Other Benefits	2 courtesy days of parking per month Emergency Ride Home	Each carpool participant will receive one alternative transportation permit per fiscal year for the purpose of driving separately on occasion, valid in same lots as carpool permit but not carpool spaces. People that do not own a vehicle are issued alternative transportation dollars that are reimbursed by various merchants. Emergency Ride Home – issued a fleet vehicle that must be returned by 8am next morning. 50% Discount on monthly Transit Passes.
Monitor Participation	Monitor payroll deduction	
Other Results of Programs		
Other Notable Features	Campus has very low drive alone mode split (20%) due to excellent transit and biking systems.	

Table C.4 – Universities of Minnesota and Wisconsin-Madison

	University of Minnesota	**University of Wisconsin - Madison**
Students	42,400 (Spring 1999), 45,300 (Fall 1999)	42,000 (1993)
Faculty/Staff	20,000	14,700 (1993)
Affiliated Institutions	Not Included	Not Included
City Population	N/A	200,000 (1993)
Metropolitan Population	2.5 million (1993)	N/A
Parking Spaces	19,200 (including both Minneapolis and St. Paul campuses)	11,000 (1993)
Parking Permits Sold	N/A	N/A
Parking Price	Contract parking: $89.50/month for garages $66.75/month for ramps $44.75/month for surface lots Daily lot rate - $2.75, Hourly rate - $2.00/hr	$890/yr. for most preferential parking to $200/yr. for least preferential parking.
Parking Limitations	Employees put name on waitlist for desired lot assignment	Applicant names are placed on waiting lists for each base lot requested. Waiting lists are maintained for campus lots by merging applicants from each department into a list for each lot. The applicant's percentile (based on priority number and dept. FTE number) determines their placement on the waiting list. Waiting lists change daily as new applications, assignments and cancellations are processed. A new applicant with a higher percentile will be placed ahead of those with lower percentiles.
Carpool Permit Cost	$1.50 per day per vehicle	Members split cost of one basic parking permit in assigned lot.
Carpool Participation	1,226 total spaces (*increased by 280% since 1989-1990*)	Over 1,700 employees and 350 students carpool or vanpool (1991).
TDM, Rideshare, or Alt. Transportation Coordinator	Unknown	Yes
Program/Eligibility Requirements	2 or more people per vehicle. Registered contract carpoolers can have multiple keycards or hangtags. If a registered carpool contract holder cancels their contract, another member of the registered carpool may take over the contract as long as two people are still carpooling. Carpool contracts must be registered for at least six months prior to be eligible for the transfer.	2 or more University employees coming to campus together in one vehicle on a routine basis. A car pool form must be completed and submitted to Transportation Services each year. Spouses coming to campus together in the same vehicle using one parking assignment are considered carpoolers. Students cannot be registered as a carpooler. The permit holder is responsible for all activity with the permit such as adding or deleting license numbers, and obtaining or returning permits when exchanging vehicles.
Rideshare Matching	Metro Commuter Services matches drivers and riders according to home addresses.	Dane County Rideshare.

Information & Marketing	Commuter Transportation Fair, brochures, and website.	Centrally located sales and information station distributes information, Campus Commuter newsletter distributed each semester, brochures, and website.
Carpool Parking Locations	Three separate garages dedicated solely for carpooling.	
Other Benefits	Guaranteed Ride Home - Individuals issued two coupons, good for six months, used to ride the bus or take a taxi home.	Permit holders may purchase 5 daily permits (non-refundable) for their assigned lot to be used on days they may also have to drive to campus. Permit holders in Lots 60, 70 and 76 may purchase an annual bus pass at 50% cost if an approved car pool form is on file with Transportation Services. Free emergency ride home (sickness or personal crisis) 3 times every 6 months, from a taxi or fleet vehicle escort.
Monitor Participation		
Other Results of Programs	Winner of various transportation, rideshare, and environmental awards (1990 – 1997). Travel mode splits – 42% drive alone, 30% walk, 13% bus, 8% bike, 7% carpool	
Other Notable Features	Parking revenues are used to support transit and other transportation alternatives. Major tunnel and skyway system between parking facilities and buildings.	Flex parking option – Refund provided for every day a vehicle is not brought to campus. Each month, Flex participants fill out a self-report form indicating transportation modes used for each day of the month. Participants pay for their entire year of parking and park in designated Flex stalls, and their refund is calculated at the end of the parking year based upon the actual amount of days that a participant drives during the parking year. Self-report forms are compared against enforcement team records.

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1. REPORT IDENTIFYING INFORMATION

A. ORIGINATING AGENCY

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA 93943

B. REPORT TITLE AND/OR NUMBER

AN EVALUATION OF THE CARPOOL PROGRAM AT THE UNIVERSITY OF FLORIDA

C. MONITOR REPORT NUMBER

BY JONATHAN B. SIEGEL, UNIV OF FLORIDA

D. PREPARED UNDER CONTRACT NUMBER

N62271-97-G-0052

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